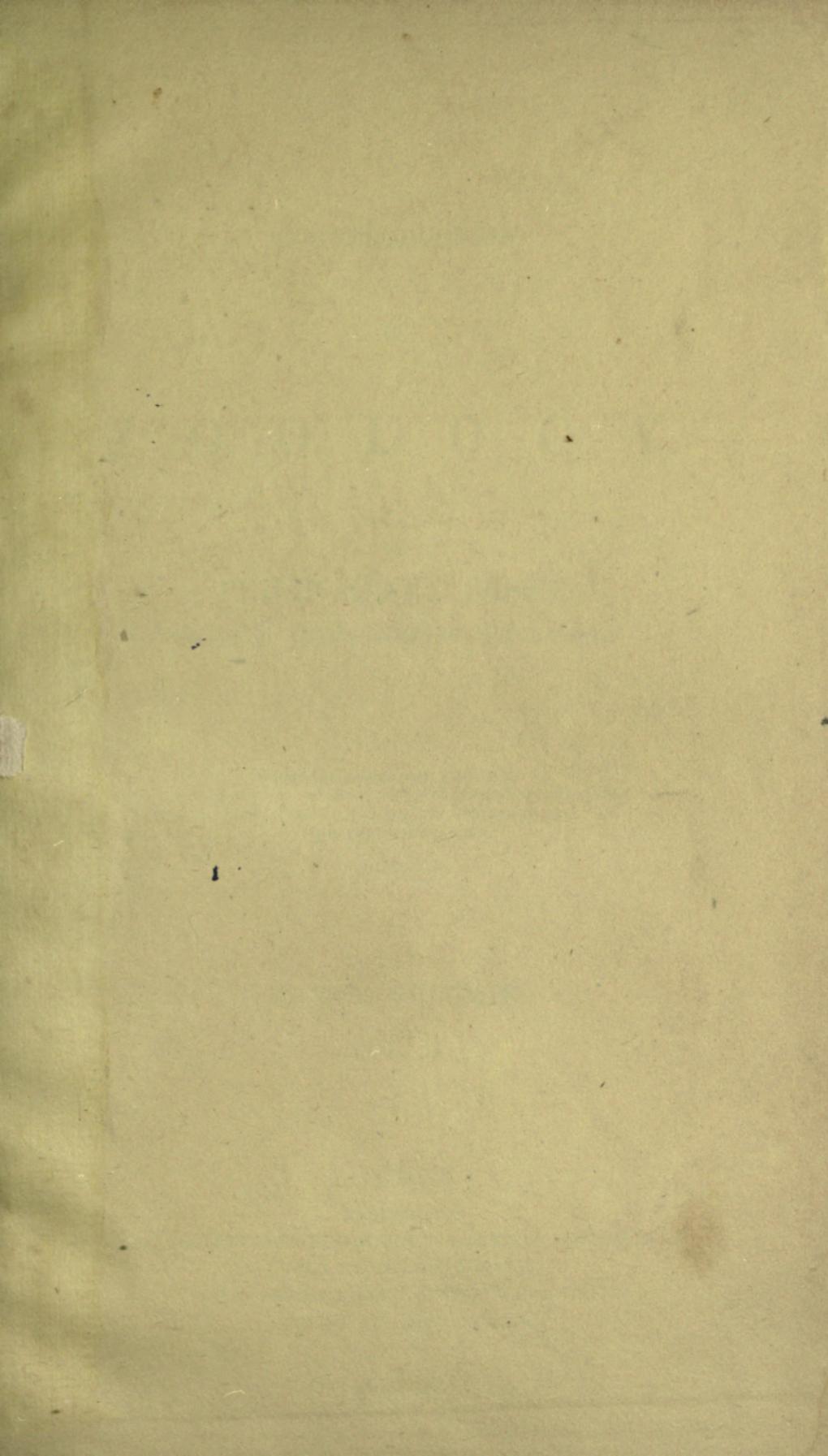
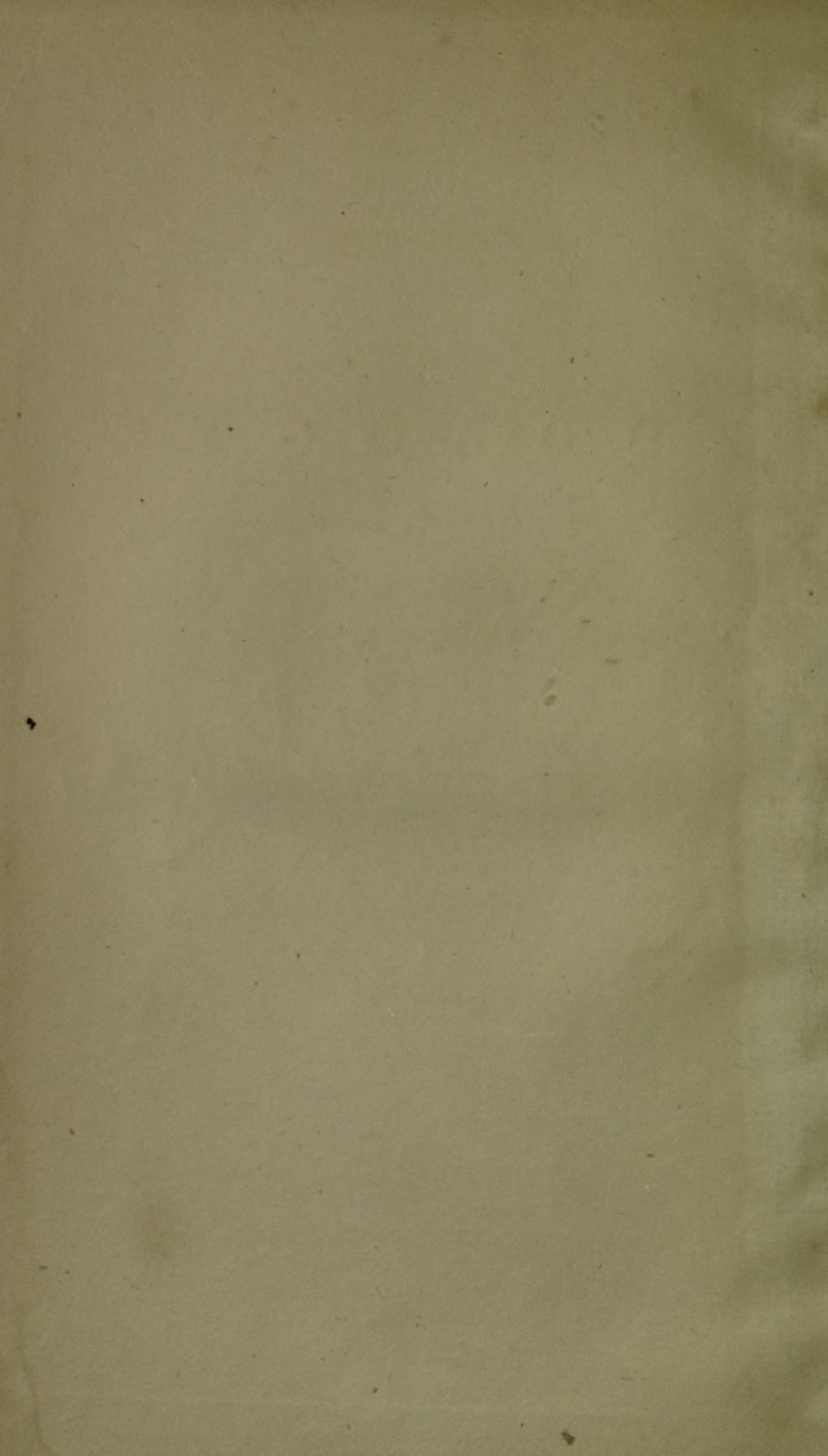


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AN INTRODUCTION

TO

Z O O L O G Y.

BY

PHILIP HENRY GOSSE,

AUTHOR OF "THE CANADIAN NATURALIST."

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ZOOLOGY.

VERTEBRATA.

CLASS III.—REPTILIA.*

“ Few beings are more worthy of the attention of the thinking observer than the proscribed and persecuted animals to whose history the course of our labours now conducts us. If the graphic and eloquent descriptions, suggested to the historians of nature by the two preceding classes of the animal kingdom, have power to instruct and delight us, with no less pleasure and profit may we accompany them in their researches on the present, and penetrate into the sombre retreats of the Reptile races in the bosom of the earth, behind the broken masses of the rock, or under the scattered débris of gigantic vegetables. We may pursue their evolutions over the tranquil surface of lakes, of streams, and rivers ; mark the tortuous folds by which they attach themselves to the branches ; and unveil the mechanism

* *Repto*, to creep.



ALLIGATOR (*Crocodilus Lucius*), AND HAWKSBILL TURTLE (*Chelonia Imbricata*).

by which they creep, climb, walk, run, leap, and even fly."*

The distinguishing characteristics of the Reptiles are as follow. The whole of the blood which passes through the heart does not pass through the lungs, but only a portion of it, varying in amount in the different genera, so that much less of heat is communicated to it, and the animal is proportionally defi-

* Griffith.

cient in sensation and vital energy. Hence, their motions are usually sluggish, and often interrupted by a death-like and long-continued lethargy: a torpor much more complete and intense than the winter sleep of some Quadrupeds. Their brain is small, and far less important to the life of the animal than that of the preceding Classes; for if it be entirely removed they continue to live for some time, and are capable of voluntary motions. Their sensations are, therefore, extremely obtuse, and their susceptibility of bodily pain comparatively feeble. Digestion is an exceedingly slow process, and food can be entirely withheld for months, and even years, without serious inconvenience, or, at least, without loss of life. It is universally found, in all animals, that *tenacity* of life is in opposite proportion to *energy* of life; that those creatures in which it is, as it were, highly concentrated, part with it suddenly, and often from slight causes; while those in which it is feeble and lethargic retain it with so firm a grasp that it continues to linger long after the privation of limbs and organs apparently the most vitally indispensable.

In consequence of their small amount of respiration, Reptiles are *cold-blooded*; that is, their blood is scarcely warmer than the temperature of the atmosphere at any given time. They, therefore, do not need such a covering as hair, wool, or feathers, to retain animal heat; and for defence a naked skin is sufficient, which in some is hardened into horny plates, or scales.

Reptiles, like Birds, produce eggs, but do not, ex-

cept in very few instances, care for them afterwards ; they are hatched by the heat of the air. In a few cases, however, they are so far advanced before laying, that the act of exclusion breaks the shell, or membrane, and the young are produced alive, as in our commonest Lizard and Viper. The young of the *Batrachians* (Frogs, &c.) live for some time in the water, and breathe by gills, as Fishes do ; but at a certain period these are lost, and the matured animal changes its element and mode of respiration. A few of the lowest genera, animals of singular conformation, retain their gills through life, and are, consequently, truly amphibious, breathing either air or water at will.

In these strange forms we see an evident affinity with such Fishes as the Lamprey, while in the Serpents there seems a leaning towards the Eels. On the other hand, we have already seen the approach to this Class made by the Penguins and Auks, while the beak of the Turtle strongly aids the resemblance. But the link which most effectually unites these two Classes is most beautifully seen in an extinct animal, called the Pterodactyle.* This must have been the most singular of all known forms, uniting in itself the characters of such different animals as the wildest fancy could hardly have put together. To the neck and head of a Swan it joined a long-pointed beak, beset with sharp teeth ; it had large wings, resembling those of the Bats, only that all the fingers but one were free, and of middling size ; this one, how-

* Πτερόν, *pteron*, a wing, and δάκτυλος, *daktylos*, a finger.

ever, was produced to an enormous length, and carried the membranous wing: the body and tail resembled those of an ordinary Mammal. Cuvier, however, satisfactorily proved that it was of the Lizard race: he considers that it flitted to and fro by means of its skin-wings; that it crawled about, or suspended itself, by the aid of the free fingers; that it stood up on the hind-feet only, like a Bird; and that in its enormous gape it caught insects, and other small animals, for which its pointed teeth were adapted. Numbers of large beetles and dragon-flies then existed, and fishes also; on which, perhaps, it preyed as it flew over the surface of the water, seizing them with its long beak. From the great size of its eyes, it was, probably, a nocturnal animal. Buckland supposes that it had the power of swimming, so common among the Reptiles, and possessed by the Vampyre-bat. "Like Milton's fiend, qualified for all services and all elements, the creature was a fit companion for the kindred Reptiles that swarmed in the seas, or crawled on the shores of a turbulent planet.

—‘The fiend

O'er bog, or steep, through strait, rough, dense, or rare,
With head, hands, wings, or feet, pursues his way;
And swims, or sinks, or wades, or creeps, or flies.’

With flocks of such-like creatures flying in the air, and shoals of no less monstrous Ichthyosauri and Plesiosauri swarming in the ocean, and gigantic Crocodiles and Tortoises crawling on the shores of the primeval lakes and rivers; air, sea, and land, must

have been strangely tenanted in those early periods of our infant world."*

Of this remarkable animal there are eight species recognised, whose size varied from that of a Snipe to that of a Cormorant.

The Reptilia have been divided into four Orders, founded chiefly on their organs of motion, and the nature of their covering; these, however, differ from each other far more than any Orders of the Superior Classes vary among themselves.

* Geol. Trans. N. S. iii. part. i.

ORDER I.—CHELONIA.*

A VERY natural and well-defined group, distinguished at the very first view by the solid and immovable armour in which the greater part of their body is encased, and which, opening at the two extremities, leaves only sufficient space for the head and fore-legs to pass out at the one, and the tail and hind-legs at the other. This bony case is composed of two parts; the upper portion, which may be called, by way of distinction, the *shell*, consists of the vertebræ, and the ribs, which are united and compacted into a continuous surface; the lower represents the sternum, united to the ribs, that is, to the shell, by several pieces immovably soldered together. Externally this armour is covered by broad plates, of a horny consistence, which in some are joined in every part of their edges to the neighbouring ones, but in others have a part of their edge free and overlapping. The skin which covers the exposed parts is so hard that the sharpest instruments can with difficulty pierce it; it is closely fastened to the shell, a little within its edge. The head is situated at the end of a neck of considerable length, which can be protruded or drawn into the shell, at the will of the animal. The jaws

* Χελώνη, *chelone*, a sea-tortoise.

take the form of a horny beak, with sharp edges, the under-mandibles shutting into the upper with great force and effect. The eggs of the Tortoises are covered with a hard shell, as in Birds, and are generally round, or nearly so. The genera are scattered over both continents.

Testudo, the Land Tortoises.*

The shell is here considerably arched, supported by a solid bony frame, soldered by its edge to the sternum. The legs appear as if the ends had been cut off; the toes are very short, and united, having five claws on each of the fore-feet, and four on the hind, thick and conical. They feed chiefly on vegetables.

The commonest species is that which is so often domesticated in this country, the Greek Tortoise (*T. Græca*). In size it is usually from six to eight inches, and inhabits the countries bordering the Mediterranean, where it feeds on leaves, fruit, and insects. On the approach of winter it digs a hole, in which it remains torpid during the cold weather. The venerable Gilbert White has given some interesting particulars of this species. “A Land Tortoise, which has been kept for thirty years in a little walled court belonging to the house where I am now visiting, retires underground about the middle of November, and comes forth again about the middle of April. When it first appears in the spring, it dis-

* The Latin name of the genus.

covers very little inclination towards food, but in the height of summer grows voracious, and then, as the summer declines, its appetite declines, so that for the last six weeks in autumn it hardly eats at all. Milky plants, such as lettuces, dandelions, sow-thistles, are its favourite dish. On the 1st of November I remarked that it began to dig the ground in order to form its winter retreat, which it had fixed on just beside a great tuft of hepaticas. It scrapes out the ground with its fore-feet, and throws it up over its back with its hind; but the motion of its legs is ridiculously slow, little exceeding the hour-hand of a clock. Nothing can be more assiduous than this creature night and day, in scooping the earth, and forcing its great body into the cavity; but, as the noons of that season proved unusually warm and sunny, it was continually interrupted and called forth by the heat in the middle of the day; and, though I continued there till the 13th of November, yet the work remained unfinished. Harsher weather, and frosty mornings, would have quickened its operations. No part of its behaviour ever struck me more than the extreme timidity it always expresses with regard to rain, for, though it has a shell that would secure it against the wheel of a loaded cart, yet does it discover as much solicitude about rain as a lady dressed in all her best attire, shuffling away on the first sprinklings, and running its head up in a corner. If attended to, it becomes an excellent weather-glass; for, as sure as it walks elate, and, as it were, on tip-toe, feeding with great earnestness in a morning, so

sure will it rain before night. It is totally a diurnal animal, and never pretends to stir after it becomes dark.

“I was much taken with its sagacity in discerning those that do it kind offices; for, as soon as the good old lady comes in sight, who has waited on it for more than thirty years, it hobbles towards its benefactress with awkward alacrity, but remains inattentive to strangers. Thus, not only ‘the Ox knoweth his owner, and the Ass his master’s crib,’ but the most abject Reptile, and torpid of beings, distinguishes the hand that feeds it, and is touched with the feelings of gratitude.”

Some time afterwards this Tortoise became Mr. White’s property, when he had an opportunity of enlarging his observations. He adds, “Towards the time of its coming forth it opens a breathing-place in the ground near its head, requiring, I conclude, a freer respiration as it becomes more alive. This creature not only goes under the earth from the middle of November to the middle of April, but sleeps great part of the summer; for it goes to bed in the longest days at four in the afternoon, and often does not stir in the morning till late. Besides, it retires to rest at every shower, and does not move at all in wet days.

“Though he loves warm weather, he avoids the hot sun; because his thick shell, when once heated, would, as the poet says of solid armour, ‘scald with safety.’ He, therefore, spends the more sultry hours under the umbrella of a large cabbage-leaf, or amid

the waving forests of an asparagus-bed. But, as he avoids heat in the summer, so in the decline of the year he improves the faint autumnal beams by getting within the reflection of a fruit-wall ; and, though he has never read that planes inclining to the horizon receive a greater share of warmth, he inclines his shell by tilting it against the wall, to collect and admit every feeble ray.”*

In Murray’s Researches in Natural History are some remarkable instances of the longevity of this Tortoise. One lived in Lambeth Palace 107 years ; another remained in the garden of the Episcopal Palace of Fulham 128 years ; and how old these were when taken is, of course, unknown. Another is mentioned to have lived 220 years ; and one in Exeter ’Change, 800 ; but this latter appears not to be sufficiently authenticated. Some records of one of these are interesting, and confirmatory of the accuracy of Mr. White.

“ From a document belonging to the archives of the Cathedral, it is well ascertained that the Tortoise at Peterborough must have been about 220 years old. Bishop Marsh’s predecessor in the See of Peterborough had remembered it above sixty years, and could recognise no visible change. He was the seventh bishop who had worn the mitre during its sojourn there.

“ This animal had its antipathies and predilections. It would eat endive, green peas, and even the leek ;

* Nat. Hist. Selb. (Ed. of Soc. Prom. Chr. Knowl.) pp. 153, 167, 278.

while it positively rejected asparagus, parsley, and spinach. In the early part of the season its favourite food was the flowers of the dandelion, of which it would devour twenty at a meal, and lettuce; of the latter, a good-sized one at a time; but, if placed between lettuce and the flowers of the dandelion, it would forsake the former for the latter. It was, also, partial to the pulp of an orange, which it sucked greedily.

"About the latter end of June it looked out for fruit, when its former choice was forsaken. It ate currants, raspberries, pears, apples, peaches, nectarines, &c., the riper the better; but would not taste cherries. Of fruits, however, the strawberry and gooseberry were the most esteemed; it made great havoc among the strawberry borders, and would take a pint of gooseberries at intervals. The gardener told me it knew him well, the hand that generally fed it, and would watch him attentively at the gooseberry-bush, where it was sure to take its station while he plucked the fruit.

"This animal moved with apparent ease, though pressed by a weight of eighteen stone: itself weighed thirteen and a half pounds. In cloudy weather it would scoop out a cavity, generally in a southern exposure, where it reposed, torpid and inactive, until the genial influence of the sun roused it from its slumber. When in this state the eyes were closed, and the head and neck a little contracted, though not drawn within the shell. Its sense of smelling was so acute that it was roused from its

lethargy if any person approached even at a distance of twelve feet."*

The Indian Tortoise (*T. Indica*) is the largest known species; it grows to the length of four feet, and is of a dull brown hue without markings. It has been brought to Europe alive. A species resembling this, (*T. Pardalis*), but of a dull yellowish tinge, with black spots, was some time in the possession of Mr. Bell, when it had the range of a small orchard, and fed heartily on grass, which it plucked with a movement similar to that of a goose. Its neck was so long and flexible, that it could raise its head above the level of its back, and thus look all around by merely turning the head. Its shell was two feet long.†

Some of the Land Tortoises (*Kinixys*‡) have the hinder portion of the shell moveable, as it were, with a hinge, so that when the feet and tail are drawn in, the shell may meet the hind part of the sternum, and close up the orifice; while others (*Pyxis*§) can close up the anterior opening by a similar hinge in the fore part of the sternum.

Emys,|| the Fresh-water Tortoises.

In these the toes are separate and webbed, and furnished with longer nails: the tail is generally

* Murray's "Researches," ed. 1830, p. 94.

† Zool. Journ. vol. iii. p. 419.

‡ Κινέω, *kineo*, to move, and ἵξυς, *ixys*, the loins.

§ Πυξίς, *pyxis*, a box. || Ἔμυς, *emys*, a tortoise.

short, and the shell somewhat flattened. Their habits are aquatic, living either in marshes or in small streams and ponds, where they prey on small fishes and water insects. The Painted Tortoise (*E. Picta*) is a beautiful species, inhabiting the rivers of North America. It is about six inches long, every plate being edged with a broad yellow border, inclosing a dark brown ground. It rests often on the trunks of fallen trees near the water's edge, into which it plunges on the least alarm. It swims swiftly, and can live long under water, but cannot survive on dry land many days. Its flesh is eaten.

In some of these, called Box Tortoises, (*Terrapene,**) there are two hinges in the sternum, by which the animal can be completely shut up as in a box. Another, called in North America the Alligator Tortoise, (*E. Serpentina,*) is marked by the tail being as long as the shell, and furnished with a sort of toothed ridge. "It attains the length of four feet, and often weighs more than twenty pounds. It is a mischievous and voracious animal, tearing young ducks and fishes, and often attacking its own species. It occasionally removes to some distance from the water. It seizes its prey, rising on its hind feet, and thrusting out its neck with great rapidity. It is said to utter a hissing cry, and, when irritated, to bite with so much violence, that there is great difficulty in forcing it to let go its

* From *terrapin*, the common name of the Land Tortoises in the United States.

hold. Schoepff reared several individuals of this species in a chamber. They always looked out for the most gloomy corners, and concealed themselves in the ashes of the chimney.”* Its flesh is much esteemed.

Chelonia,† the Turtle.

The bony armour in the Sea-tortoises, or Turtles, is not large enough to allow the head and feet to be withdrawn; the feet being very long, especially the fore ones, and flattened so as to resemble fins, of which they perform the office. The toes are all enveloped in a common membrane, and only two are furnished with nails, one of which is often wanting. The plates of the sternum are separated by spaces filled with cartilage. The body is flattened, so as to pass more swiftly through the water, and some species are said to resemble in the celerity and the ease of their motion the progress of a bird in the air.

The Green Turtle, (*C. Mydas*), the species so highly prized at civic feasts for the delicate flavour of its flesh and *fat*, is found about the tropical shores of the Atlantic and Indian Oceans, and particularly in the West Indies. To the little uninhabited islets of sand, *keys*, as they are called, which are so numerous on the Florida Reef, these Turtles with other species resort in vast numbers to lay their

* Griffith's Cuvier, 1831, vol. ix. p. 80.

† Χελώνη, *chelone*, a sea-tortoise.

eggs, and that from a great distance. Audubon has given a lively picture of their operations.—“On first nearing the shore, and mostly on fine, calm, moonlight nights, the Turtle raises her head above the water, being still distant thirty or forty yards from the beach, looks around her, and attentively examines the objects on shore. Should she observe nothing likely to disturb her intended operations, she emits a loud hissing sound, by which such of her many enemies as are unaccustomed to it are startled, and so are apt to remove to another place, although unseen by her. Should she hear any noise, or perceive any indications of danger, she instantly sinks and goes off to a considerable distance; but, should everything be quiet, she advances slowly towards the beach, crawls over it, her head raised to the full stretch of her neck; and when she has reached a place fitted for her purpose, she gazes all around in silence.

“Finding ‘all well,’ she proceeds to form a hole in the sand, which she effects by removing it from *under* her body with her *hind* flappers, scooping it out with so much dexterity that the sides seldom, if ever, fall in. The sand is raised alternately with each flapper, as with a large ladle, until it has accumulated behind her, when, supporting herself with her head and fore-part on the ground fronting her body, she with a spring from each flapper sends the sand around her, scattering it to the distance of several feet. In this manner the hole is dug to the depth of eighteen inches, or sometimes more

than two feet. This labour I have seen performed in the short period of nine minutes. The eggs are then dropped one by one, and disposed in regular layers to the number of a hundred and fifty, or sometimes nearly two hundred. The whole time spent in this part of the operation may be about twenty minutes. She now scrapes the loose sand back over the eggs, and so levels and smooths the surface, that few persons on seeing the spot could imagine anything had been done to it. This accomplished to her mind, she retreats to the water with all possible despatch, leaving the hatching of the eggs to the heat of the sand."*

This species is one of the most useful products of tropical climates, furnishing to seamen an aliment both wholesome and agreeable, and a sure remedy for that scourge of mariners, the scurvy. It feeds chiefly on sea-weeds, on which it grazes at the bottom of the water. Other species feed also on various kinds of shell-fish; the Loggerhead in particular feeds on the animal of the great Conch-shells, (*Strombus,*) which with its powerful beak it crunches with as much ease as a man cracks a walnut.†

The Hawk's-bill Turtle (*C. Imbricata*) is the most useful next to the preceding, and perhaps the most remarkable of all. The beak is sharper and more hooked, having a very singular resemblance to that of a Hawk. The plates of the shell are ridged, and overlap one another like the tiles of a house. It is from these plates that the beau-

* Orn. Biog. vol. ii. p. 370.

† Audubon.

tiful substance called tortoise-shell is obtained, no other species being available for this purpose. By immersion in boiling water the plates become quite soft, and being subjected to pressure, are made perfectly flat; two pieces are even soldered together by the same process so completely as to shew no line of union, and even the scrapings and filings, with any small pieces that may be cut away, being softened by heat and placed in metallic moulds, are pressed into any required form at pleasure.* The use of this substance was known to the ancients, by whom it was highly prized. The species is less than the Green Turtle, but inhabits the same seas: its flesh is disagreeable and unwholesome.

The Loggerhead (*C. Caretta*) is the largest of the genus, attaining the enormous size of eight or nine feet, and the weight of fifteen hundred pounds. It is of no value for its flesh or shell, but it affords a considerable quantity of oil for lamps. It is a dangerous animal, from its courage and ferocity.

A species of scarcely less dimensions, though a native of the Mediterranean, has occasionally strayed to our own shores; its body is covered with a tough leathery skin, without scales or plates. It is the Leathery Turtle (*C. Coriacea*). The first lyre is reported to have been formed of its shell.

* Dumeril et Bibron.

Trionyx, the Soft-shelled Tortoises.*

These also, like the last, are destitute of plates, the shell and sternum being merely encased by a thick skin, which is widened into a free and flexible margin, and serves, like the side fins of the Flatfishes, to enable them to scuttle along at the bottom of the rivers they inhabit. Their feet have three nails. An American species (*T. Ferox*) is vigorous and daring, defending itself with great fierceness and activity, darting on its assailant, and biting with great violence. It feeds on birds and other animals, devours young Alligators, and is in turn devoured by the old ones.

Connecting the Tortoises with the next Order, or rather forming an intermediate one, were some gigantic animals which wallowed in the seas of a former condition of our world, "making the deep to be hoary," but of which the fossil bones alone now remain. We will just glance at their strange and singular forms. The first has been named *Icthyosaurus*,† literally Fish-lizard; it combined the snout of a Dolphin with the teeth of a Crocodile; the head of a Lizard with the spine of a Fish; the breast-bone of an *Ornithorhynchus* (Duckbill) with the

* Τρεις, treis, three, and ὄνυξ, onyx, a nail.

† Ἰχθύς, ichthys, a fish, and σαῦρος, sauros, a lizard.

paddle fins of a Whale. Its general outline was that of a monstrous Porpoise; it had four broad fin-like feet, a long powerful tail, probably dilated at the end vertically. Mr. Owen thinks that it was clothed with a skin like the *Cetacea*, without scales, perhaps between that of the Shark and that of the Leathery Turtles. It probably came ashore to sleep and to lay its eggs. Specimens have been found nearly thirty feet in length.

The *Plesiosaurus** was still more remarkable in its deviation from present forms. The head of a Lizard, furnished with teeth like those of a Crocodile, was placed at the end of an enormously long and slender neck, like the body of a Serpent, while the trunk and tail had the proportions of an ordinary quadruped; the ribs were those of a Chameleon, and the paddles those of a Whale.† Mr. Conybeare supposes that it was marine; that it occasionally came on shore, where it moved awkwardly; that its long neck would be an impediment in swimming submerged, and therefore it probably swam on or near the surface, its long neck elevated out of water and arched like that of a swan, darting down on its finny prey among the seaweeds that clustered in the shallows.

* Πλενσίος, *plesios*, near, and σαῦρος, *sauros*, a lizard.

† Buckland.

ORDER II.—SAURIA.*

The Saurians have the body and tail of a lengthened form, clothed either with scales or a shagreened skin. There is no shell corresponding to that of the Tortoises. The feet are generally four, but some few species, merging into the Serpent race, have but two, and some have them so imperfect as to be scarcely worthy of the name. The toes are usually furnished with crooked claws.

The Order is an exceedingly numerous one, and its subjects vary much in structure and habits. Some, as the Crocodiles, inhabit lakes and rivers; others, as the Iguanas, live among the foliage of trees; some, as the Dragons, perform a sort of flight like that of the Flying Squirrels; some of the true Lizards delight to bask in the genial rays of the sun on exposed sandy banks, others conceal themselves in the humid forests, beneath stones and rotten logs. Some crawl with a motion disgustingly sluggish, others run with a celerity that the eye can scarcely follow. Though found in almost all countries, the fervent sun of the tropics seems chiefly to call them into being, and it is more especially in such regions as have a moist as well as a hot atmosphere, that they chiefly swarm. The

* Σαῦρος, sauros, a lizard.

banks of the Nile, the swampy regions of Guiana and Florida, the sunny isles of the West Indies, the tepid jungles of the Eastern Islands teem with innumerable hosts of Saurian Reptiles.

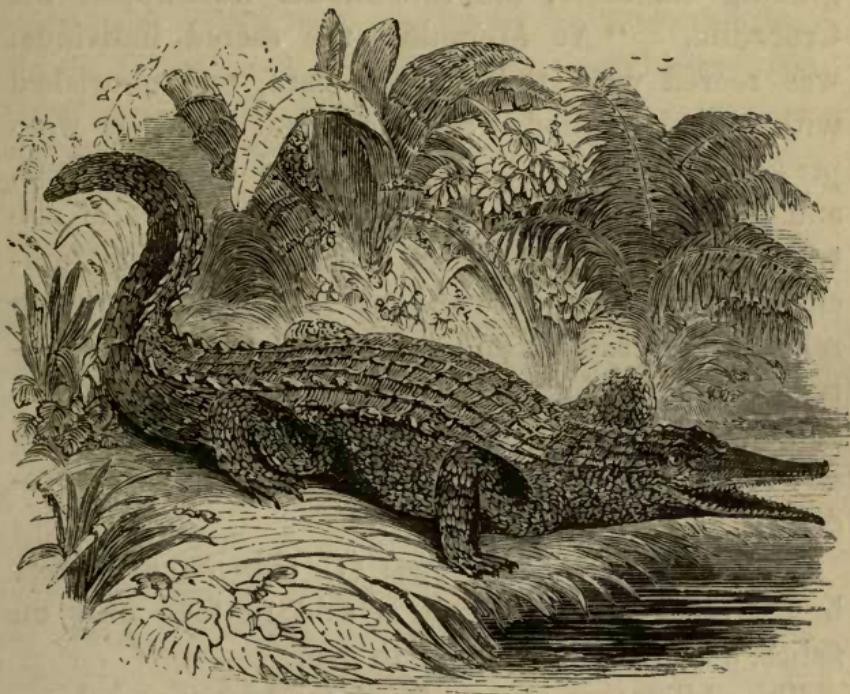
The food of these animals is chiefly animal ; small quadrupeds, birds, worms, and insects, according to their size and power. Some, however, are said to feed on fruits. Their digestion is slow, and they eat but seldom.

Crocodilus, the Crocodiles.*

Attaining an immense size, furnished with a coat of mail almost invulnerable, armed with strong and pointed teeth, curved claws, great strength of jaws, and a savage ferocity, these animals have in all ages been regarded with terror as the scourges of the rivers which they inhabit. The body is defended by stout, large scales, ridged down the centre ; the tail is flattened at the sides, and crowned with a notched crest, double at the base : the plates on the belly are thin and smooth. The terror inspired by these Reptiles is increased by the malignity of their countenance, arising from their fiery eyes placed obliquely and near to each other, but more especially from the fact of their serried teeth being always displayed, as if the creature were animated by a diabolical fury, the lips being entirely wanting. It seems, however, that their formidable character has been much overrated, and they are often success-

* The Greek name of the animal.

fully attacked by a single man. The great rigidity of their body causes them to have much difficulty in turning, so that their fury is easily eluded, at least, on land.



CROCODILE (*Crocodilus Niloticus*).

The Egyptian Crocodile (*C. Niloticus*) has been celebrated in all ages ; it is probably the Leviathan of the earliest book extant, the Book of Job. It inhabits the Upper Nile, but does not now descend, as formerly, to the Delta. The Senegal, Gambia, and other rivers of Western Africa are infested with Crocodiles closely allied to, if not identical with, the present. It is marked by having six rows of

square plates along the whole length of the back. Individuals have been seen of more than thirty feet in length. In ancient Egypt, whose idolatry, with all its learning, was of the most besotted and degrading character, the inhabitants worshipped the Crocodile. “At Memphis, the sacred individual was reared with the greatest care, and nourished with abundant food. Sacrifices and offerings were presented to him: he was adorned with trinkets, and lodged in a lake or basin in the midst of the temple. Thus treated, the Crocodile lost its ferocity, and became so tame as to be led about in religious processions and ceremonies. In that country, so vaunted for wisdom, persons have been known sufficiently foolish and infatuated to rejoice when any of their children were devoured by the Crocodile.”*

The Gavial of the Ganges (*C. Gangeticus*) differs but slightly from this: it is said to feed only on fishes, and to be inoffensive to man.

The Alligators are confined to America, and are distinguished from the true Crocodiles merely by slight differences in the teeth: they are frequently termed Caymans. The Pike Alligator (*C. Lucius*) is common in the great rivers of America, especially in the Southern United States, where it attains the length of fifteen feet.

* Griffith's An. Kingd. 1831, ix. 91.

*Monitor.**

The tongue is capable of being thrust out, and terminates in two threads: the toes, five on each foot, are unwebbed, armed with nails, and very unequal in length; the scales beneath the body, and round the tail, are arranged in parallel bands. They have two teeth in each jaw, but none in the palate; most of them have the tail flattened, as in the Crocodiles. They inhabit both continents, and are said to give warning, by hissing, of the approach of the Crocodile, whence their name. They are frequently of large size, but intermediate in this respect between the last genus and the true Lizards. The Great Dragon of Guiana (*M. Crocodilinus*) has some resemblance to the genus after which it is named, having rigid scales scattered along the back. It climbs trees with great agility, runs with some speed, but swims badly. It preys on reptiles, and other small animals, in the marshes and flooded meadows of South America, though it is not partial to absolute immersion in the water. Its flesh is eaten; but it is rather difficult to procure it, for the animal burrows in the ground, and bites desperately. Its length is six feet, so that it is somewhat formidable.

Lacerta,† the Lizards.

This appellation, applied by Linnæus to all the Saurians, is now used to signify only those whose

* *Moneo*, to warn.

† Their ancient Latin name.

palate is armed with two rows of teeth ; whose neck is furnished with a collar formed of large scales, separate from those on the breast, and loosely overlapping them ; and whose skull projects in a ridge over the eyes. The head is covered with broad plates ; the scales of the back do not overlap each other. On the inner surface of the thighs the scales are perforated with pores, the use of which is unknown. Our own two species, the only Saurians we possess, the Sand Lizard (*L. Agilis*), and the Viviparous Lizard (*L. Vivipara*), belong to this genus. We prefer, however, to give a slight notice of the Great Green Lizard (*L. Ocellata*). This is the most beautiful of the tribe ; it is more than a foot long, of a brilliant green, which glistens with a golden lustre in the sun, marked with lines of black dots, forming rings, or eyes. In the whole South of Europe it is frequently seen on dry heaths and banks, climbing on the bushes and hedges, and over rocks, searching for insects. It is stated that this lovely reptile captures and devours frogs, and even shrews and mice, and that it seeks out the eggs of small birds. In the stomach of one dissected by M. Poirier, a smaller lizard, of another species, was found entire. It does not seem to be much afraid even of man, biting with great violence the end of a stick held to it. It will even leap up, and fasten on the muzzle of a dog, if attacked, and will sooner die than relinquish its hold. The vulgar regard its bite as venomous, but this is an unfounded supposition.

*Agama.**

The tongue in this, and some of the following genera, is fleshy and thick, not divided, nor capable of protrusion ; the head is bulky, and somewhat heart-shaped, covered with small scales ; the body is thick, clothed with a loose skin, which the animal has the power of inflating ; it is covered uniformly with small scales more or less projecting : the palate is without teeth ; the neck is slender, and furnished behind the ears with pointed spines.

One species, inhabiting the warmer parts of America, (*A. Orbicularis*,) has been called the Spinous Toad, from its resemblance to that reptile. The body is large and corpulent, and the tail very short, so that its form is very unlike that of a Lizard. The back part of the head is armed with sharp spines, whence it has been called the Horned Agama ; spines are also scattered over the whole body. Its colour is ashy grey, with brown spots ; its length about six inches.

Draco,† the Dragon.

The imagination of the ignorant and unlettered, craving after the marvellous, has, in all ages, delighted to create to itself fabulous beings, which it has endowed with powers, forms, and attributes the

* A negro name.

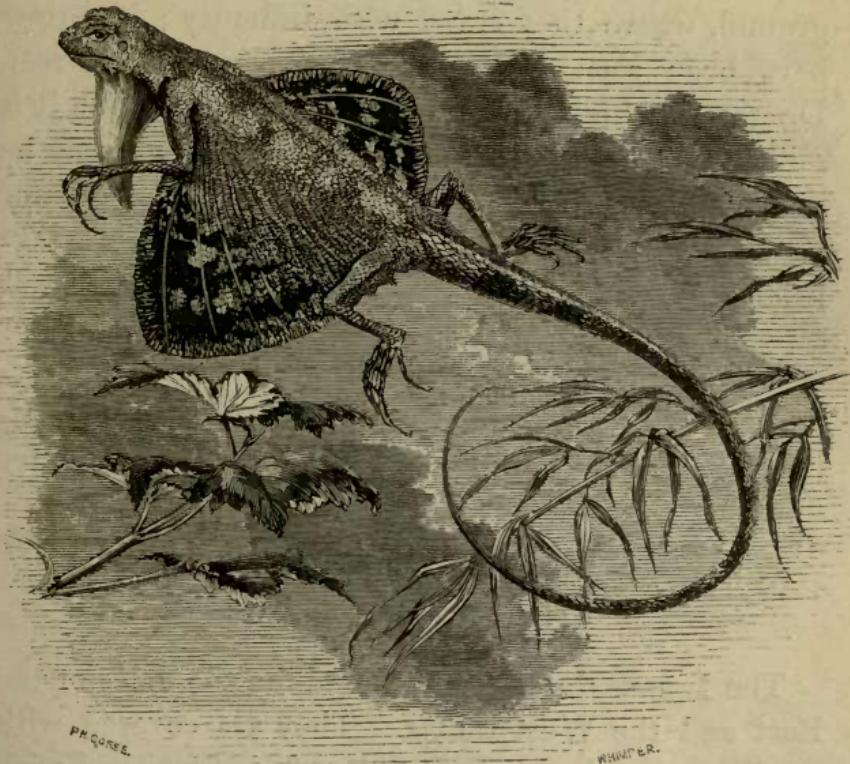
† Δράκων, *drakon*, a fabulous animal of antiquity.

most heterogeneous and contradictory. Of these imaginary creatures none have been more renowned than the Dragon, a monster depicted with supernatural power and ferocity, with a hideous form bristling with spinous crests, covered with scaly armour, furnished with terrible fangs, and an envenomed tongue, with spiny wings and barbed tail, vomiting flames ; the guardian of hidden treasure, or the scourge and devastation of nations. “ Rendered celebrated,” says Lacépède, “ by the songs of Greece and Rome ; the principal ornament of pious fables imagined in more recent times ; conquered by heroes, and even by youthful heroines, who were contending for a divine law ; adopted by a second mythology, which placed the fairies on the throne of the enchantresses of old, the emblem of the splendid actions of valiant knights, he has enlivened modern, as he animated ancient poetry.

“ Proclaimed by the severe voice of history ; everywhere described, everywhere celebrated, everywhere dreaded ; exhibited under all forms ; always clothed with tremendous power, and immolating his victims by a single glance ; transporting himself through the midst of the clouds with the rapidity of lightning ; dissipating the darkness of night by the terrific splendour of his glaring eyes ; uniting the agility of the eagle, the strength of the lion, the magnitude of the giant serpent ; sometimes presented under a human figure, endowed with an intelligence almost divine, and adored, even in our own days, in the great empires of the east ; the Dragon, in short, has been all

in all, and everywhere to be found, *except in Nature.*"

But, what sad havock do modern naturalists play with all this time-honoured poetry and romance, when they apply the terrible name of Dragon to a



GREEN DRAGON (*Draco Viridis*).

little Lizard only a few inches in length, running about the twigs of trees, in pursuit of flies, and distinguished from other Lizards merely by its first six ribs projecting outwards, and supporting an extended

membrane, by which, as a parachute, it is enabled to take longer leaps than usual ! It has, also, a long, pointed dewlap under the throat, which can be inflated. The wings (if so they may be called) are folded up during rest. The Dragons are harmless little animals, inhabiting the forests of Africa and the Indian Islands : they rarely descend to the ground, where they crawl with difficulty ; but they have been seen swimming in a river. The Green Dragon (*D. Viridis*) is common enough in Java : it is said to inflate its dewlap when it flies, that it may be lighter ; but its flights do not extend to a greater distance than thirty paces ; the agitation of its wings produces a slight noise. It is neither venomous nor mischievous. The inhabitants handle it without fear or danger, and it is often itself devoured by serpents.* Shaw believes that it is in the habit of filling its dewlap with insects, preserving them there for some hours, and afterwards feeding on them.

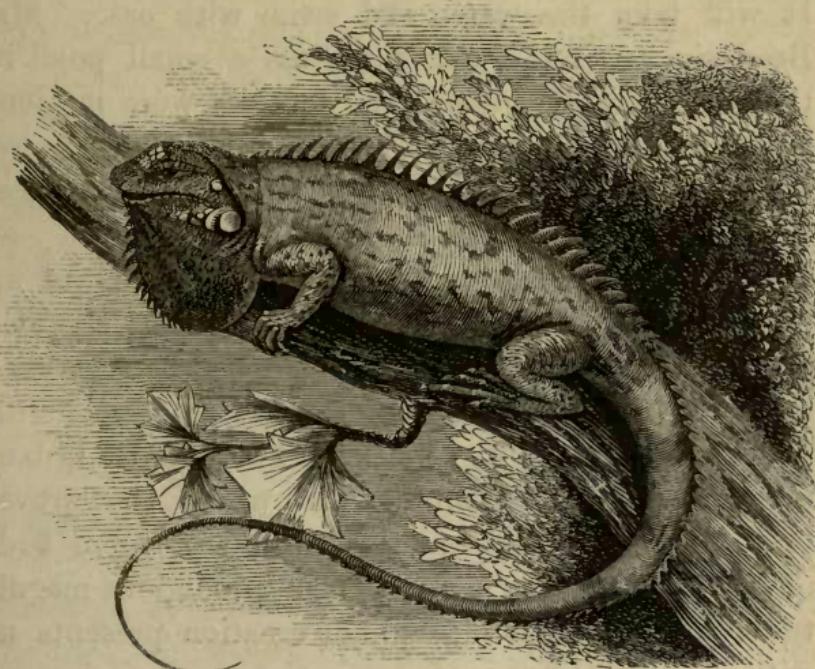
Iguana,† *the Iguana.*

The Iguanas are chiefly found in the Isles of the East and the West Indies. They are covered with small overlapping scales ; the neck is furnished with a long, pendent dewlap, notched at the edge : a range of erect spinous scales runs down the back ; the head is covered with plates ; the teeth are peculiar, being compressed, and triangular, the edges cut into notches, like a saw. The Iguana, so common in

* Bontius.

+ A negro name.

the West Indies, (*I. Tuberculata*,) is four or five feet long, marbled with various shades of green. It passes its time mostly on trees, at the edges of rivers and springs. It is said to be herbivorous, eating leaves and flowers. Mr. Broderip saw a living



THE SCALY IGUANA (*I. Squamosa*).

Iguana, about two feet long, in a hot-house near Bristol. It had refused insects, and other animal food, till, happening to be near some kidney-bean plants, it began to eat their leaves, and was thenceforth supplied with those plants. To this account Dr. Buckland adds, that Captain Belcher, in 1828, found in the Island of Isabella swarms of Iguanas,

that appeared to be omnivorous, feeding voraciously on the eggs of birds, the intestines of fowls, and insects. Though not venomous or dangerous, its bite is exceedingly painful: it has great powers of endurance, sustaining easily the blows of a cudgel; it is therefore usually shot with the arrow or the gun. It will take the water and swim with ease. Mr. Broderip saw one enter and cross a small pond in the Zoological Gardens: the forefeet were motionless during its passage. The flesh is a great delicacy, but unfortunately it is somewhat unwholesome. The eggs are also much esteemed.

Some fossil remains have been discovered of an enormous reptile, whose teeth were of the singular form of the Iguana's, and which has been thence named *Iguanodon*.* It was seventy feet in length, and had a horn on its snout. "The gigantic Iguanodon," says Mr. Mantell, "to whom the groves of palms and arborescent ferns would be mere beds of reeds, must have been of such prodigious magnitude, that the existing animal creation presents us with no fit objects of comparison. Imagine an animal of the Lizard tribe, three or four times as large as the largest Crocodile; having jaws, with teeth equal in size to the incisors of the Rhinoceros; and crested with horn: such a creature must have been the *Iguanodon*!"

* From *Iguana*, and ὄδοντος, *odontos*, a tooth.

Basiliscus, the Basilisk.*

This is another name of renown. The worthy Aldrovandus has favoured us with a veritable engraving of the royal reptile, with eight feet, a long and hooked beak, and a *crown* upon his head! It was said to have the power of striking its victim dead at a glance, and to chase all other animals from its regal residence, by the terrific tones of its voice. To add to its marvellous reputation, it proceeded from the egg, forsooth, of a *cock*! Of course there is no more connexion between this fabled animal, and the Saurian we are about to describe, than between the Dragon of ancient fable and the little winged reptile of Java. Naturalists have, however, as in the former case, chosen to avail themselves of a well-known name, and to apply it to a real animal, which had been previously unknown.

The Basilisk, then, is an Iguana with a tail flattened sideways, a fin-like crest running down the middle of the back, and a sort of elevated hood at the back of the head. The single species known (*B. Mitratus*) is of a bluish tint, attains a large size, inhabits South America, and feeds on fruits. Little is known of its habits, but, from its form, it is probably more or less aquatic.

* Βασιλικὸς, *basilikos*, kingly.

*Anolis.**

These pretty and agile Lizards inhabit trees, on the branches of which they run to and fro, and leap from leaf to leaf with great dexterity and precision. To facilitate these motions, their toes have the skin of one joint dilated into a little oval disk, and their nails are much hooked. The skin is shagreened with small scales, and they have a dewlap under the throat, which they inflate when excited. Many of them have the power of changing their colours like the Chameleons. The species are confined to America. The Green Anolis (*A. Bullaris*) is common in the Southern United States; it is hardly so large as our little Viviparous Lizard, and usually of a bright yellowish green. It is a most active little creature, pursuing winged insects to the extremity of the twigs, with great agility, and taking surprising leaps from one bush to another. When irritated, the dewlap swells to a great size, and becomes of a bright crimson. The writer has had the pleasure of witnessing its changes of hue, from bright green to blackish brown, and *vice versâ*, an alteration very completely, though slowly and gradually effected. It is a quarrelsome little creature. “When two of these animals attack each other, it is always with boldness. They appear to threaten by rapidly agitating the head. The throat swells; their eyes sparkle; and they seize each other with fury, and fight with bitterness. The weakest takes to flight, his enemy

* A native name.

pursues him with vivacity, and devours, if he overtake him. But sometimes he is able only to seize him by the tail, which breaks easily in his mouth, and which he swallows. Those which have been thus mutilated, grow timid, feeble, and languishing.”* Mr. Bell records an interesting fact of this species, which shews that the pursuit of its prey is not unattended with danger. He had two specimens of this *Anolis* in his possession, of which he says, “I was in the habit of feeding them with flies and other insects, and having one day placed in the cage with them a very large Garden Spider, (*Epeira Diadema*,) one of the Lizards darted at it, but seized it only by the leg. The Spider instantly ran round and round the creature’s mouth, weaving a very thick web around both jaws, and then gave it a severe bite in the lip, just as this species of Spider usually does with any large insect which it has taken. The Lizard was greatly distressed, and I removed the Spider, and rubbed off the web, the confinement of which appeared to give it great annoyance; but in a few days it died, though previously in as perfect health as its companion, which lived for a long time afterwards.”†

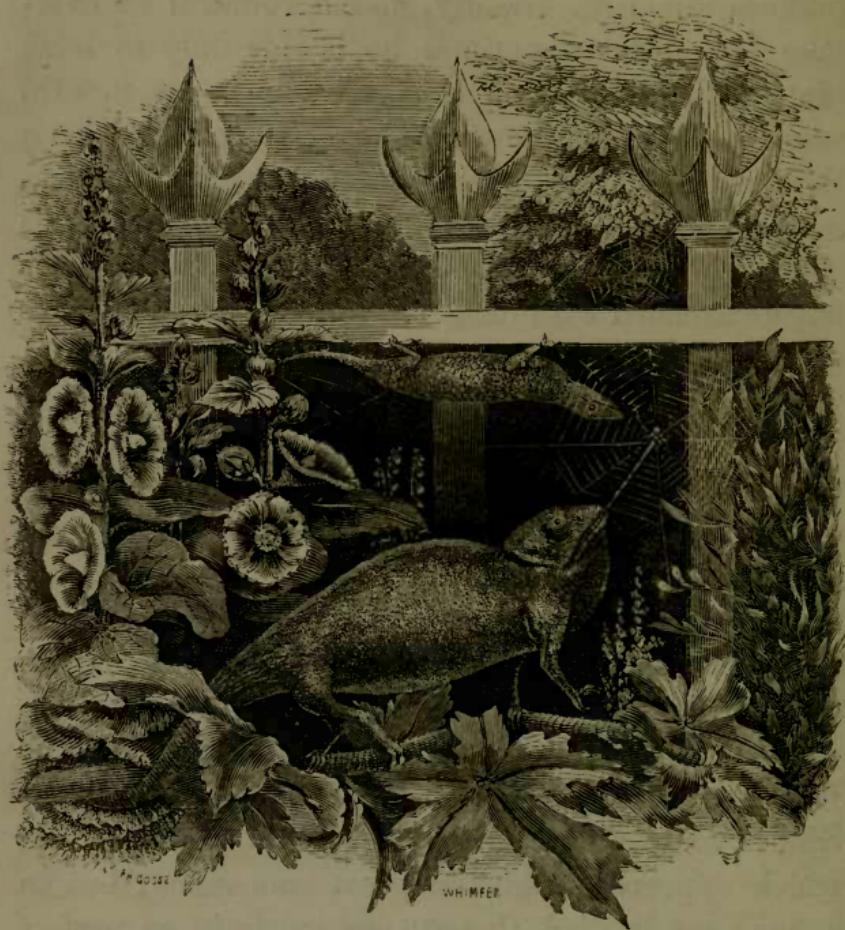
Ascalabotes,‡ the Gecko.

The singular form of the Geckos, their dull and melancholy aspect, and their resemblance to the Toads and Salamanders, sufficiently distinguish them,

* Lacépède.

+ Brit. Rept. *Introd.* xx.

‡ The Greek name of some lizard.



WALL GECKO (*Ascalabotes Fascicularis*), AND COMMON CHAMELEON
(*Chamæleo Africanus*).

and have caused them to be both dreaded and hated in the countries where they reside. It is a numerous genus, scattered over both continents, composed of nocturnal animals, with large eyes, whose pupils contract by day like those of a cat. The circumstance of their eyelids not being visible gives them a singular appearance. They are of a flattened form;

covered with very small scales. The toes are dilated at the edges, and they can adhere to a plane surface so firmly, as even to crawl beneath a ceiling: their length is nearly equal, and they are furnished with claws, which, strange to say, are retractile, a circumstance which, in conjunction with their eyes, causes them to represent, in Cuvier's opinion, the Cats among Reptiles. It appears that their bad reputation is not wholly groundless, for Hasselquist remarks of the House Gecko, (*A. Gecko,*) a species that infests cellars, &c., on the borders of the Mediterranean, that a poison exudes from its toes. He saw at Cairo, two women and a girl, at the point of death, from having eaten some cheese, over which a Gecko had crawled. At another time, he saw the hand of a man, who would lay hold of the reptile, instantly covered with red pustules, inflamed and itching.

Chamæleo, the Chameleon.*

— Perhaps the most singular form in all the existing Saurian tribes is shewn by the Chameleons, indicative of habits not less remarkable. Their compressed body, flattened to an edge at the back, is clothed with minute scaly grains, like shagreen: the tail is prehensile, twining round objects, and grasping them: the five toes of each foot are divided into two sets of three and two respectively, each set being united by a common skin as far as the nails, and the two

* Χαμαιλέων, *chamaileon*, the Greek name of the animal.

sets being placed in opposition to each other, so that it is a real climbing foot: the tongue is long, cylindrical, and capable of being protruded with great swiftness at flies, which are taken by an adhesive saliva at its extremity: the eyes are nearly covered by the skin, and have the very singular property of moving independently of each other. The lungs are of enormous size, almost filling the abdomen, so that when they are inflated, the animal is semi-transparent, and hence it was supposed to feed on air. The inflation of the lungs in different degrees, is perhaps the cause of the changes of colour for which this animal has been so celebrated. The skin is yellow, and the blood of a lively violet blue. The blood, then, projected from the heart to the surface of the body in varying quantity and force, according to the emotions of the animal, will cause the surface to assume different shades of yellow, green, blue, or grey; which its other fluids may also slightly influence. There are many species common in the warm countries of the old continent, and one, (*C. Africanus*,) even extends to southern Europe. It is a harmless animal, and even useful, as lessening the number of annoying insects. It is extremely gentle in its manners. One may take it in his hand, and put his finger into its mouth, without any danger of being bitten.* It walks awkwardly in all situations, and therefore does not pursue its insect prey, but, concealed beneath the leaves, it waits for them to come within the reach of

* Griffith.

its slender tongue, when they are shot with the rapidity of lightning.

Mr. Slight has recorded some particulars of two which were sent to him from Malaga, and lived in his possession several months. They were kept unconfined in a wicker basket, in a bow-window, and slept many hours in the day, lying on a projecting ridge of the wicker-work. During sun-shine, they flattened themselves to expose a larger surface to its influence, when they were usually of a greenish stone colour and pale. If disturbed, they contracted their abdomen, expanding the ribs, and often became instantly of a dark green, or even indigo green. *Sometimes, only one side changed colour.* The larger was vigorous, and in health; when awake, its eye (of a dark colour and very lustrous) was turned in every direction, the motions being by a kind of jerk, and very rapid as if in search of prey. Mr. S. was accustomed to put six or seven cockroaches in a shallow tin vessel, and the Chameleon on its edge, with its head projecting over the brim. After making a circuit round a portion of the vessel, it would distend the throat-pouch, and stretching forward its body, on the fore-legs, it would suddenly dart out its tongue with such force, as to make a very sensible ringing on the opposite side of the tin. It would catch the insect in the trumpet-shaped extremity of the tongue, which was retracted quick as lightning, and mastication and swallowing followed. In this manner it would take three or four insects from the vessel; but fed only

once in three or four days, and would not eat hard-shelled beetles. They generally slept on the top of the basket, their heads projecting over the edge, and their tails curled round one of the small divisions of the wicker-work, and it was curious to observe the firmness of their hold in this way. On going in with a candle, they always appeared of a pale ashy stone colour, or a spectral blue, like the tint cast upon the face, by coming opposite a blue bottle in a chemist's window. Their motions were exceedingly slow, always firmly attaching one foot before letting go with the other. They were lost several times, and Mr. S. was afraid to step about the room, lest he should tread on them, but they were generally found in the folds of the curtains, not on the blue lining, but on the chintz. One side was often seen nearly of a stone colour, while the other was blackish green: the changes of hue were always rapid, and attended by either elevation or depression of the ribs. Mr. S. adds, "the skin of the creatures I should liken to an infinite number of facets of a certain determinate figure, and I think the changes of colour depended on the power of the animals to elevate, alter, and depress the faces or angles of these facets, and the consequent difference of angle at which the light was received."* This theory is certainly ingenious, and might easily be confirmed, if correct, by microscopical examination.

* Loudon's Mag. N. H. iii. 232.

*Scincus, the Scink.**

In the smooth rounded body, the short feet, the small equal scales, we see in all the Scinks an approximation to the serpent-form; and in the lower genera, the characters, as we shall see, become so modified, that the line of distinction between these Orders cannot be drawn.

The Common Scink (*S. Officinalis*) was formerly in high esteem for its supposed medicinal virtues, which were represented as ridiculously various. Modern science, however, has thrown it into disrepute. It inhabits the north of Africa, is about eight inches long, of a silvery yellow, with darker bands. There is little that is interesting in its manners, except the extreme facility with which it burrows in the sand, when disturbed.

In the genus *Seps*,† the body is still more lengthened, and the feet smaller and removed farther apart. In *Bipes*,‡ the fore limbs are not visible, though there are shoulder-blades concealed within the skin; the hind feet are exceedingly short, and are without claws. Finally in *Chirotes*,§ the hind-feet are lost, while the fore ones, small and rudimentary, are visible. Other points in the anatomy of these Reptiles shew the same gradual transition to the Serpents.

* The ancient Greek name of some lizard.

† The Latin name of a venomous worm.

‡ *Bis*, twice, *pes*, a foot.

§ *Xείρ*, *cheir*, a hand.

ORDER III.—OPHIDIA.*

To the Serpent races alone does the term “Reptile” strictly apply, as in them there are no external limbs, and, in most, even the last rudiments have disappeared from the skeleton. Their body is greatly lengthened; there are three families.

FAM. I.—ANGUINA.†

Anguis, the Slow-worm.

Notwithstanding their serpentine form, the Slow-worms are more closely allied in structure and habits to the last Order than to the present. They are completely covered with small overlapping scales, possess visible eyelids, have a solid bony head, and the rudiments of limbs in the skeleton. On the other hand, one of the lungs is much less developed than the other. The common Slow-worm or Blind-worm of our own country, (*A. Fragilis*,) is a good example of the genus. It is about a foot in length, of a silvery brownish hue, with some lines of dots. The general form is nearly cylindrical, scarcely tapering to the head and tail. It is a gentle, inoffensive creature, rarely attempting to bite even when handled, and if it attempt to do so, the teeth are too feeble to pierce the skin. It is so timid that, on being frightened, it contracts so

* "Οφις, ophis, a serpent, and εἶδος, eidos, likeness. † *Anguis*, a snake.

forcibly as to become quite stiff and motionless ; and in this state it is so brittle as to snap in two like a piece of glass, a quality belonging in a less degree to many of the Lizards. Mr. George Daniel has given the following account of the species in captivity :—“ A Blind-worm that I kept alive for nine weeks would, when touched, turn and bite, although not very sharply ; its bite was not sufficient to draw blood, but it always retained its hold until released. It drank sparingly of milk, raising the head when drinking. It fed upon the little white Slug, (*Limax Agrestis*), so common in fields and gardens, eating six or seven of them one after the other, but it did not eat every day. It invariably took them in one position. Elevating its head slowly above its victim, it would suddenly seize the slug by the middle, in the same way that a ferret or dog will generally take a rat by the loins ; it would then hold it thus sometimes for more than a minute, when it would pass its prey through its jaws, and swallow the slug head foremost. It refused the larger slugs, and would not touch either young frogs or mice. Snakes, kept in the same cage, took both frogs and mice. The Blind-worm avoided the water ; the Snakes, on the contrary, coiled themselves in the pan containing water, which was put into the cage, and appeared to delight in it. The Blind-worm was a remarkably fine one, measuring fifteen inches in length. It cast its slough while in my keeping. The skin came off in separate pieces, the largest of which was two inches in

length; splitting first on the belly, and the peeling from the head being completed the last.”*

It is scarcely necessary to add, that the epithet “blind,” by which it is so often called, is by no means descriptive.

In a species from the Cape of Good Hope, (*A. Meleagris*), the general structure is that of the Slow-worms, but there is no internal vestige of either pair of limbs, so gradual are the steps by which nature passes from one form to another.

FAM. II.—SERPENTIA.†

The limbs no longer appear in most of the genera of this family, and yet in a few there is still the recurrence of a vestige concealed in the flesh, representing the hind pair: and the great Boas do even show externally a sort of hook, which answers to the hind foot. The eyelid is not visible, and there is no external ear. The first genus does not, however, exhibit the full characters of the true Serpents.

Amphisbæna.‡

To this American genus, of course unknown to the ancients, an ancient name has been given, originally applied to a fabulous snake which was reputed to have a head at each extremity. It is, however, perfectly applicable to this, for from the

* White’s Selborne. (Bennett’s Edit.) † *Serpo*, to creep.

‡ Ἀμφίσ, *amphis*, both ways, and βαίνω, *baino*, to go.

regular form of the body it moves backward or forward with equal facility; and, as the tail is blunt and almost as thick as the head, and the eyes so small as to be scarcely observable, it is not easy at first to determine the one from the other. The *Amphisbænæ* are not venomous; the body is surrounded with rings of square scales; the jaws are still so constructed as to be incapable of stretching in the manner of the true Serpents. They have but one lung.

In the true Serpents, which are very numerous, the jaws are so loosely jointed with each other as to be capable of a very wide separation, enabling them to swallow animals larger than their own usual bulk. The palate is armed with sharp teeth, which curve backward, and aid in the swallowing of the prey. Most of them have but one large lung. Their motion is peculiar; the ribs are very numerous, and serve as feet; the animal resting on their extremities and moving them in turn, just as a Centipede crawls, whose feet indeed they exactly resemble, except in being within the skin. At the same time, it is upon the lateral motion of the body, and the alternate lateral pressure of successive portions of it, that the Serpents mainly depend for the rapidity of their progression.*

The Serpents are conveniently divided into those which are harmless and those which are venomous. The differences between these are not sufficiently obvious to be manifest at a glance; but they can

* Bell's Br. Rep.

readily be distinguished by an accurate examination.

The harmless Serpents, or, more correctly, the non-venomous, (for many of these are highly formidable from their vast strength,) have the upper and lower jaws and the palate furnished with fixed and solid teeth, so that there are four rows above and two below. In most, the hind-head is much widened, and the tongue forked, and capable of being thrust out.

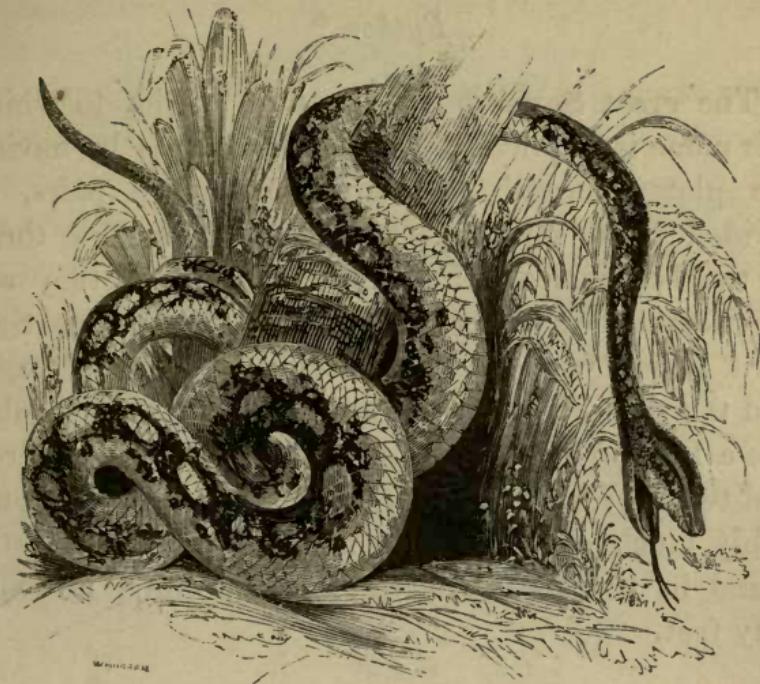
*Boa.**

This name has often been applied without much precision to all Serpents of great size, but it properly belongs to those American species which have the body and tail covered on the under side with undivided plates, a hook on each side at the base of the tail, a compressed body, thickest in the middle, a tail capable of grasping by twining round bodies, and the hind head (and sometimes the whole head) covered with small scales. The largest Serpents are among the Boas, some, as the *B. Constrictor*,† *B. Scytale*,‡ and *B. Cenchrus*,§ frequently attaining the length of thirty feet, and even more. They are said to lie in wait near the outlets of the forest, or at the drinking places; and when a quadruped, even of such size as deer, or wolves, (and, as has been reported, but this is very doubtful, oxen and buffaloes,) approaches, they suddenly dart upon it, and

* An ancient name of a large serpent.

† *Constringo*, to bind together. ‡ *Σκύτος*, *skytos*, a scale.

§ *Κίγχρις*, *kenchris*, the ancient name of some large serpent.



BOA CONSTRICCTOR.

enveloping it in enormous folds, with the speed of thought, crush the bones by a powerful and irresistible muscular contraction. When assured that their victim is dead, they slowly relax their pressure, and having covered the whole animal with a glutinous saliva, proceed to swallow it entire. In this operation, if the prey be large, the jaws and throat are enormously dilated, and the horns or other prominences may be seen for days, as if ready to burst through the distended skin. After a meal of this kind, the Reptile remains in a state of helpless lethargy until digestion is completed, and hunger again rouses it to exertion.

*Python.**

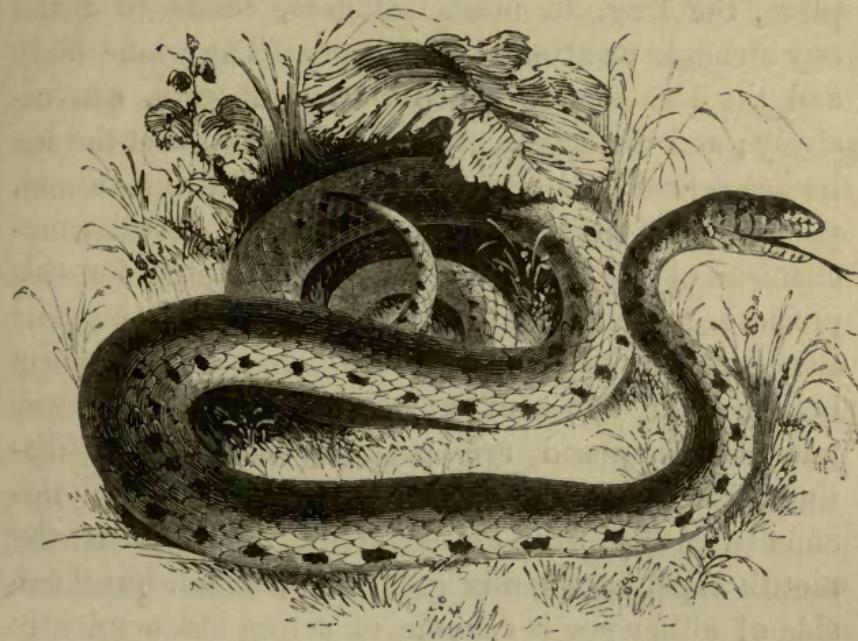
The great Serpents of the Old World, to which this name is applied, differ from the Boas by having the plates beneath the tail arranged in pairs, or divided in the middle. Their habits resemble those of the last-named genus, to which indeed they are nowise inferior in magnitude. The enormous Serpent which was killed by Regulus near Carthage, and the skin of which was sent to Rome, was doubtless a Python ; it is said to have measured a hundred and twenty feet in length ; but its size has been probably much exaggerated. Some, however, are still found in the great Asiatic Islands, which measure fifty feet.

Coluber,† the Snakes.

This is the most numerous genus of all the Serpents, and found in all countries. The head is oval, or nearly so, covered with plates, usually nine in number ; the gape is wide ; the plates under the tail, as in the last genus, are double ; the scales of the body generally ridged. The common Ringed Snake (*C. Natrix*) of our own country, may illustrate the genus. It is too well known to need any description of its form or markings, but the following very interesting account of its mode of taking its prey will not be unacceptable, especially as it throws light

* The Greek name of an enormous serpent.

† The Latin name for a snake.

COMMON SNAKE (*Coluber Natrix*).

on the manners of the whole Order. After observing that it preys on small animals, but especially on frogs, Mr. Bell goes on to say, "I have seen one of these voracious creatures in pursuit of a frog, which appeared perfectly conscious of its approaching fate, leaping with less and less power as it found its situation more hopeless and the crisis of its fate approaching, and uttering its peculiar weak cry with more than usual shrillness, until at length it was seized by its pursuer by the hinder leg, and gradually devoured. The manner in which the Snake takes its prey is very curious. If it be a frog, it generally seizes it by the hinder leg, because it is usually taken in pursuit. As soon as this takes

place, the frog, in most instances, ceases to make any struggle or attempt to escape. The whole body and the legs are stretched out, as it were, convulsively; and the Snake gradually draws in first the leg he has seized, and afterwards the rest of the animal, portion after portion, by means of the peculiar mechanism of the jaws, so admirably adapted for this purpose. It must be recollectcd, that, in the true Serpents, unlike the group to which the Slow-worm belongs, the bones of which the upper and lower jaw are composed are perfectly and loosely distinct from each other, and connected only by ligaments." By this arrangement, not only is the mouth capable of being greatly expanded, but "one side of either jaw is capable of acting independently of the other; and as the animal is gradually taking its prey, one side of the jaw is extended forwards, and the two rows of teeth of the upper and the single row of the lower fixed into the skin; then the opposite side of the jaws is stretched forwards in the same manner, and so on alternately until the victim is thus gradually and often slowly conveyed into the gullet, and by the muscular action of this part it is swallowed. When a frog is in the process of being swallowed in this manner, as soon as the Snake's jaws have reached the body, the other hinder leg becomes turned forwards; and as the body gradually disappears, the three legs and the head are seen standing forwards out of the Snake's mouth in a very singular manner.

* * *

"The scene above described is one which I have

often witnessed ; and I once saw two Snakes seize upon the same hapless frog. As this circumstance is not unlikely to happen in their native state, it may not be out of place to mention the result. On placing a frog in a large box, in which were several Snakes, one of the latter instantly seized it by one of the hinder legs, and immediately afterwards another of the Snakes took forcible possession of the fore-leg of the opposite side. Each continued its inroads upon the poor frog's limb and body, until at length the upper jaws of the two Snakes met, and one of them in the course of its progress slightly bit the jaw of the other. This was retaliated, though evidently without any hostile feeling ; but, after one or two such accidents, the more powerful of the Snakes commenced shaking the other, which still had hold of the frog, with great violence from side to side against the sides of the box. After a few moments' rest, the other returned the attack, and at length the one which had last seized the frog, having a less firm hold, was shaken off, and the victor swallowed the prey in quiet. No sooner was this curious contest over, than I put another frog into the box, which was at once seized and swallowed by the unsuccessful combatant.

“The frog is generally alive not only during the process of swallowing, but even after it has passed into the stomach. I once saw a very small one, which had been swallowed by a large Snake in my possession, leap again out of the mouth of the latter, which happened to gape, as they frequently do,

immediately after taking food. And on another occasion, I heard a frog distinctly utter its peculiar cry several minutes after it had been swallowed by the Snake.”*

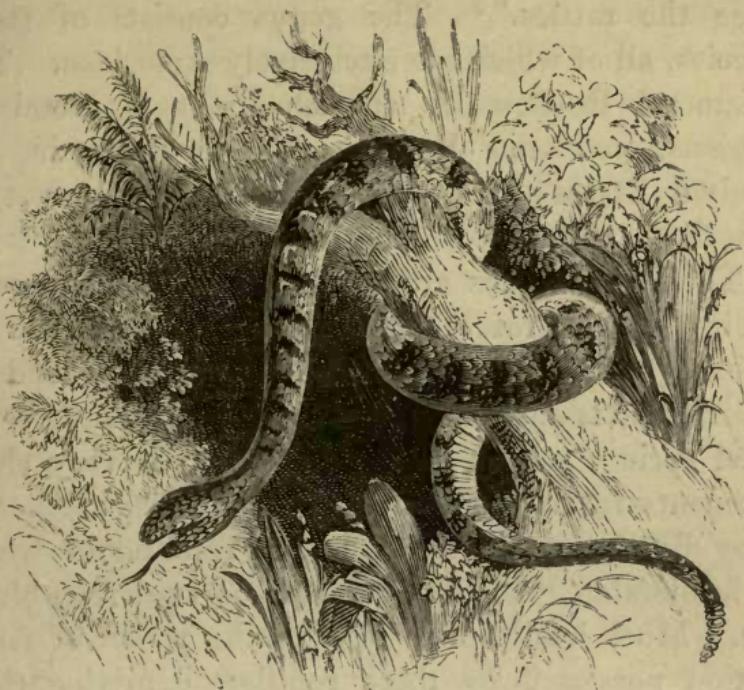
The venomous Serpents resemble the others in most of their external characters, but the structure of the mouth is very different. The upper jaw is destitute of the small ordinary teeth found in the former, but is furnished in their stead with a single long, curved, and tubular tooth, which usually lies down upon the jaw, and is hidden in a fold of the skin, but, when the Serpent wishes to bite, is erected. The tube of the tooth passes into a little bag in the gum, filled with a liquid poison secreted by glands for the purpose ; and the act of biting, by the pressure of the fang upon the poison-bag, causes the fluid to be forced through the tube into the wound. The result of the admixture of this substance with the blood is well known, but the effects vary in violence according to climate, season, health, both of the reptile and the victim, and other causes. The two rows of teeth are present in the palate, as in other Serpents.

Crotalus,† the Rattlesnake.

The very singular appendage to the tail of these reptiles has given them their name : it consists of

* Brit. Rept. p. 51.

† Κρόταλον, *krotalon*, a rattle.



BANDED RATTLESNAKE (*Crotalus Horridus*).

a varying number of hollow, horny, or bony cups, each one fitting into the next, where it is loosely held, which at the will of the animal are agitated with a tremulous motion and produce a peculiar rattling sound. It is commonly believed that one of these appendages is added at every moult, and that the age of the Snake may be determined by their number. But it is stated in a paper on the North American Reptilia by Dr. Harlan, published in the Journal of the Academy of Natural Sciences, Philadelphia, that, "the rattle is cast annually, and consequently no inference as to the age of the animal can be drawn from the number of pieces which com-

pose the rattles."* The genus consists of many species, all of which are exclusively American. The Diamond Rattlesnake (*C. Durissus*) is found in Guiana, and the Banded (*C. Horridus*) in the United States; both are sometimes six feet in length.

The Rattlesnakes are somewhat dull and inert in their motions, rarely attacking man or the larger animals unless provoked. The warning sound of their rattle is always given some moments before the fatal spring, and as their progression is very slow, accidents rarely occur. Like most other Serpents, they diffuse, when excited, a most fetid odour, which is intolerable. Their usual prey is squirrels, birds, &c. Much has been written of the power of fascination possessed by these reptiles, depriving their intended victim of all power to flee, and even drawing them, as if by a resistless influence, into the very jaws of the destroyer. Some writers have attempted to explain away a great deal of this attributed power, by imputing it to the paralysing effect of fear, to the stupifying power of the odour, &c.; but still much seems to remain unaccounted for. The poison is not always equally virulent. If the Serpent make several successive attacks at short intervals, it seems that the result becomes much more feeble at every bite, the poison becoming comparatively exhausted. Mr. Bell records an instance in which three rats were successively introduced into the cage of a Rattlesnake, with very different results.

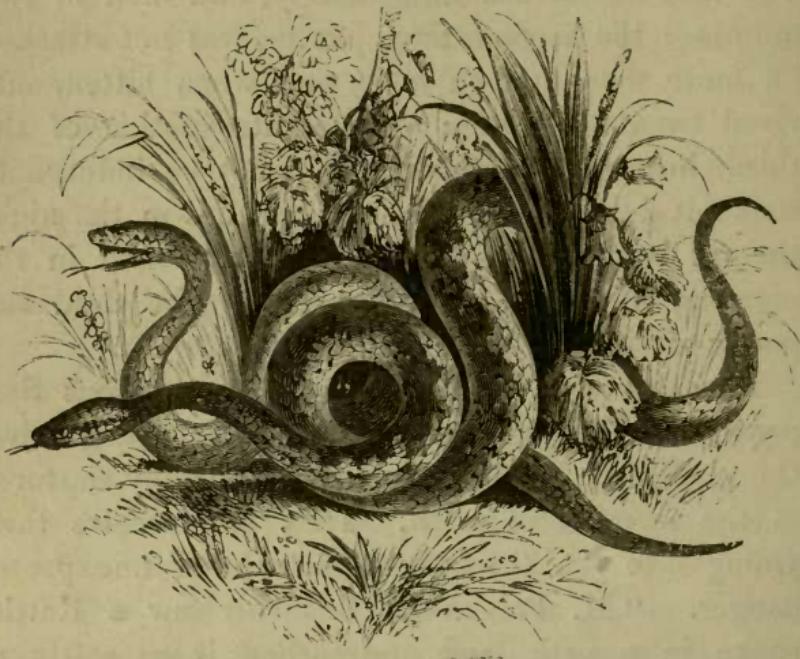
* Vol. v. p. 363.

The first was struck immediately, and died in two minutes; the second, then put in, was not attacked for more than half an hour, and, when bitten, survived twenty minutes; on the introduction of the third, however, the Snake could not be induced to strike it during the whole evening, but in the night the rat became the aggressor, being found in the morning alive and well, but the Snake dead and partly eaten.*

Like our own Viper, and other venomous Serpents, the Rattlesnakes produce their young alive, the membrane of the egg being probably ruptured in the moment of birth. They also receive their young into the throat in a moment of unexpected danger. “M. Palisot de Beauvois saw a Rattlesnake in a path, and approached it as softly as possible. At the moment when it was about to be struck, the animal agitated its rattles, opened a wide throat, and received into it five little ones, each about as thick as a goose-quill: but at the end of ten minutes, believing itself out of danger, it opened its mouth again and let the young ones out, which, however, entered there again on the appearance of a new danger. Mr. Guillemart has verified the same fact.”†

* Br. Rept. p. 62.

† Griffith, An. King. vol. ix. p. 344.



COMMON VIPER (*Vipera Berus*).

Vipera, the Viper.*

Distinguished from the last by being destitute of anything like rattles, and by wanting a little hollow before the eyes, which is found in the Rattle-snakes, the Vipers resemble the Colubers in appearance, but are highly poisonous. The English Viper (*V. Berus*) is the only venomous reptile that infests our country. It is common on heaths, dry banks, &c.; but may readily be distinguished from the Common Snake (*Coluber Natrix*) by the series of

* Its Latin name, from *vivipara*, producing living young.

diamond-shaped blackish spots which run down the back, forming a broad zigzag band on the brownish ground colour of the body: there is also a row of spots on each side of this band. The Snake, on the other hand, is marked merely with four rows of black spots, on a greenish-grey ground.

The Viper is highly poisonous, instances being by no means rare of its bite proving fatal to man, especially in the more southern countries. We scarcely need notice the absurd notion still prevalent among the vulgar, that the soft forked tongue is the instrument of vengeance. It is true that the reptile protrudes and retracts it rapidly when angry, but it is utterly incapable of producing any injury. The envenomed weapons are, as in the Rattlesnakes, the curved fangs of the upper jaw.

The terrible symptoms which follow the bite of this and other poisonous Serpents are,—a sharp pain in the part, which becomes swollen, shining, hot, red, then livid, cold, and insensible. The pain and inflammation spread, and become more intense; fierce shooting pains are felt in other parts, and a burning fire pervades the body. The eyes begin to water abundantly: then come swoonings, sickness, and bilious vomitings, difficult breathing, cold sweat, and sharp pains in the loins. The skin becomes deadly pale or deep yellow, while a black watery blood runs from the wound, which changes to a yellowish matter. Violent headache succeeds, and giddiness, faintness, and overwhelming terrors, burning thirst, gushing discharges of blood from the

orifices of the body, intolerable fetor of breath, convulsive hiccoughs, and death. These results, as we have already observed, vary in degree in different cases. If the wound be sucked at the instant, the poison may be extracted without injury, as was proved by Dr. Cloquet, the stomach being in no way affected by its introduction; but if it have remained some time, the best remedies are olive oil applied outwardly, and ammonia inwardly.

The Cerastes (*V. Cerastes*) is a highly venomous species found in Northern Africa, and often mentioned by the ancients. It is remarkable for the presence of a small horn-like projection on each eyebrow. Another much dreaded Serpent is the Cobra de Capello, or Spectacled Snake (*V. Naja*) of the East Indies, remarkable for the body being widened just behind the head, where it bears a mark having some resemblance to a pair of spectacles. Both these species, but especially the latter, are notorious for the power over them, and impunity from their bites, possessed by certain individuals, the serpent charmers of antiquity, and the jugglers of modern India. Much, however, as has been said on this subject, great as has been the scepticism manifested, and rigid as has been the investigation of the circumstances, it may safely be asserted that, beyond the bare facts, which cannot be controverted, we know just nothing of the matter.

FAM. III.—APHOLIDOTA.*

Cæcilia.†

This single genus, the only one of the family, is another of those singular forms which, while they puzzle the naturalist, at the same time delight him by showing the connexion between widely differing animals. A Serpent has little resemblance to a Frog ; yet here is a genus of animals about which naturalists are divided as to its relationship, some choosing to place it with the one, and some with the other.

These animals have the lengthened form of the Serpents, but the skin is quite destitute of external scales ; these are, however, found on dissection imbedded in the skin. Outwardly it is soft and glutinous, but furrowed by a great number of wrinkles that go round the body. The ribs are very short, the joints of the spine formed and connected as in Fishes. There can scarcely be said to be any tail, as the vent is at the extremity of the body. Many other details of their anatomy shew a structure equally singular.

Of the manners or habits of the *Cæcilia* we know nothing ; the *C. Annulata*, a native of Brazil, is said to live in marshes many feet below the surface ; vegetable substances and earth have been found in their stomachs.

* *A*, without, and *φολίς, pholis*, a scale.

† *Cæcus*, blind.

ORDER IV.—BATRACHIA.*

IN these the heart has but two cavities, distinguishing them from the other Reptilia, in which it has three: the lungs are equal. They are covered with a naked skin, destitute of all scales or shell. But they are particularly remarkable for the important alteration which in most cases takes place in their structure at a certain period of their life. The eggs are invariably committed to the water, where the young animals are hatched under the semblance of fishes, and that not merely in outward form, but in the essential condition of their existence. Unlike the adult from which it is descended the tadpole breathes not by lungs but by gills, respiration water instead of air. It possesses a long and muscular tail, by the flexure of which it swims rapidly as fishes do: it has no limbs. It feeds chiefly on vegetable matters in a state of decomposition. After living in this fish-like state for some weeks, the gills become gradually absorbed, the lungs begin to appear, the hind legs form, and soon the fore ones, the tail (in some instances) becomes shorter and finally vanishes, and thus the *fish* becomes a *reptile*, capable of breathing the air and of capturing living prey. Some of the lowest

* Βάτραχος, *batrachos*, a frog.

genera, however, retain the gills even after the acquisition of lungs, and thus are truly amphibious, being qualified to live either in air or water. But, besides these two modes of respiration, there is yet another found in these interesting animals. It is effected through the moist and naked skin, the surface of which has the power of extracting *oxygen* from the atmosphere; by which Frogs have been known to sustain life for many weeks after the total loss of their lungs. It is necessary, however, that the surface be moist; and to supply moisture to the skin there is a beautiful provision made in a copious internal reservoir, fitted to contain water. "Every one knows that when a Frog is hastily seized, or even quickly pursued, it voids a considerable quantity of water, which is generally but erroneously supposed to be the urine. This water is limpid and pure, containing no traces of the usual component elements of the urinary secretion. It is contained in a sac, which has also been mistakenly believed to be the urinary bladder. This is the reservoir to which I have alluded. When, therefore, the Frog is happily placed in a damp atmosphere or in water, the skin absorbs a quantity of water, which, there is every reason to believe, is secreted into the bladder just mentioned, where it is kept in store until the dryness of the skin requires a supply for the purpose of respiration, when it is again taken up and restored to the surface by which it had been first absorbed."*

* Bell's Br. Rept. p. 79.

Rana, the Frog.*

This and the two following genera have, when arrived at the adult state, four perfectly formed limbs, but no tail. The head is large and flattened, with a very wide mouth, in which there is a soft tongue attached to the edges of the jaws, and folding inwards. There are four toes to the fore feet and five to the hind: the body is short and *squat*; the ribs are wanting. They do not breathe as higher animals do, but *swallow* air by means of the muscles of the throat, and expire it by contracting the abdomen. The eggs are inclosed in a glutinous slime, and laid in the water, in which, as observed above, they pass their tadpole state, and beneath which the adults pass their winters in a state of torpidity. The true Frogs have the hind legs and feet very long, and thus fitted for those powerful and agile leaps, for which they are so distinguished: they are efficient aids in swimming, being *struck out* as a man uses his legs in a similar action. The upper jaw and palate are furnished with small teeth. Their voices are loud and harsh, sometimes a hoarse croak, at others a shrill ringing shriek of great volume.

The nimble and useful, and, in spite of prejudice, pretty little Frog of our own marshes, (*R. Temporaria*,) is known to every child. Of its youthful form, so different from the adult, and of its consequent transformations, we have already spoken; and every one who will take the trouble to keep a

* Its Latin name.

few of the myriads of tadpoles that scuttle along in every ditch in spring, may in a few weeks verify the facts, and obtain some information in a delightfully practical manner.

The Frog feeds on various insects, worms, and slugs ; on this account it is a very useful inhabitant of a garden, where it will live very well without water among the damp plants. The following account of its mode of taking food is given by the Rev. T. W. Bree :— “ A friend happened to be re-potting some green-house plants, and meeting with a moderate-sized worm among the roots, he carelessly threw it aside into a damp corner near the green-house. Almost immediately a Frog issued from his lurking place hard by, commenced his attack upon the worm, and soon dispatched it. Another worm was thrown to him, which he treated in the same manner. But the amusing part of the business is to watch the manner in which the Frog first notices his prey, and this I can compare to nothing so aptly as a pointer dog setting his game. He makes, indeed, a dead set at it, and oftentimes too, (if the relative position of the two animals so require it,) with a slight bend or inclination of the fore part of the body to one side, just as we often see a pointer turn suddenly when the game is on one side of him, and he has approached very near before he has perceived it. After a pause of some seconds or more, the Frog makes a dart at the worm, endeavouring to seize it with his mouth ; in this attempt he frequently fails more than once, and

generally waits for a short interval, acting the pointer, as it were, between each attack. Having succeeded at last in getting the worm into his mouth, if it be a large one he is unable to swallow it immediately and all at once; and the portion of the worm which yet remains unswallowed and extends out of the mouth of its destroyer, of course writhes about, and struggles with a tortuous motion. With much, but somewhat grotesque dexterity, the Frog then employs his two fore feet, shoving and bandying the worm first with the one and then with the other, in order to keep it as nearly as may be in the centre of his mouth till the whole is swallowed.”*

A still more interesting trait in the character of this despised reptile is recorded by Mr. Bell, of one in the possession of a friend of his for several years “in a perfect state of domestication. It appears that the lower offices of his house were underground on the banks of the Thames; that this little reptile accidentally appeared to his servants, occasionally issuing from a hole in the skirting of the kitchen; and that during the first year of his sojourn, he constantly withdrew upon their approach, but from their shewing him kindness, and offering him such food as they thought he could partake of, he gradually acquired habits of familiarity and friendship; and during the following three years he regularly came out every day, and particularly at the hour of meal-time, and partook of the food which the servants gave him. But one of the most remarkable features in his artificial state of existence, was

* Loudon’s Mag. N. H. iii. p. 326.

his strong partiality for warmth, as, during the winter seasons, he regularly (and contrary to the cold-blooded tendency of his nature) came out of his hole in the evening, and directly made for the hearth in front of a good kitchen fire, where he would continue to bask and enjoy himself until the family retired to rest. There happened to be at the same time a favourite old domestic cat, and a sort of intimacy or attachment existed between these two incongruous inmates : the Frog frequently nestling under the warm fur of the cat, whilst the cat appeared extremely jealous of interrupting the comforts and convenience of the Frog. This curious scene was often witnessed by many besides the family.”*

We the more willingly repeat such narratives as this, because we would fain root out from the minds, especially of the young, the groundless prejudice which associates with these creatures everything that is ugly, unclean, and disgusting. In too many parts of our “enlightened” country, the innocent and useful Frog is persecuted wherever it is seen, stoned and beaten to death to gratify that vitiated and brutalized appetite which can find a Satanic delight in the agonies of the defenceless and unoffending. “ Yet who,” says Lacépède, “ can regard with disgust a being whose form is light, whose movements are nimble, and whose attitudes are graceful ? Let us not deprive ourselves of an additional source of pleasure ; and in our walks through the smiling fields, let us not regret that the banks of the rivulets are adorned by the colours of these harmless

* Br. Rep. p. 98.

animals, and animated by their light and lively gambols. Let us contemplate their little manœuvres, observe them in the midst of the calm lakes, whose solitude they relieve without troubling their repose; see them exhibit beneath the sheets of water the most agreeable tints, cleave the bosom of the tranquil stream, and vary its silvery surface with many a circling furrow."

Hyla, the Tree-frog.*



TREE-FROG (*Hyla Viridis*).

We have no example of this genus in England, though one (*H. Viridis*) is common on the conti-

* "Tλην, hyle, a wood.

nent, and several inhabit North America. They differ from the true Frogs by having the tips of the toes dilated into a little round disk, by means of which they cling to leaves and twigs of trees, and will even climb the glass of a window. They reside in trees, pursuing insects, but spawn in water.

Bufo, the Toad.*

It is probably from the ugliness of its person, the season of its activity, the places of its resort, and the sluggishness of its motions, that the Toad in all ages has been slandered and libelled as the very concentration of venom and malice. It is certainly of a most ungainly aspect, the warty skin, the broken back, and the puffed-out belly, give it an appearance eminently unpleasing: it is nocturnal in its habits, frequenting gloomy, damp, and noisome retreats; its pace is a heavy crawl, and in its futile attempts to leap it appears to break down in the midst and come short of its aim. It has been esteemed poisonous too; but, though there is some foundation for this belief, (we speak of our English species, *B. Vulgaris,) it is not in the way, nor to the extent which would warrant the customary abhorrence with which it is viewed. The Toad cannot, like the Viper, poison its victim by biting it, nor by spitting at it, nor by breathing on it, nor by looking at it, all of which have been at times asserted and believed. But there is a secretion produced from the warts*

* Its Latin name.

of the skin, which is of an inflammatory character, and which has been known to produce eruptions upon the hands of those who have handled it. This seems to be the extent of its offending. Its food is the same as that of the Frog, and is taken in the same manner. Like the other Reptilia it sheds its skin at times ; but, while that of the Frog comes off piecemeal, in shreds in the water, the Toad throws off his at once, as we would shift a garment. We will again have recourse to the interesting book of Mr. Bell, who was fortunately a witness of the process. “ Having often found amongst several Toads, which I was then keeping, some of brighter colours than usual, and with the surface moist and very smooth, I had supposed that this appearance might depend upon the state of the animal’s health, or the influence of some peculiarity in one or other of its functions. On watching carefully, however, I one day observed a large one, the skin of which was particularly dry and dull in its colours, with a bright streak down the middle of the back ; and on examining further I discovered a corresponding line along the belly. This proved to rise from an entire slit in the old skin, which exposed to view the new and brighter skin underneath. I soon observed that the two halves of the skin, thus completely divided, continued to recede farther and farther from the centre, and become folded and wrinkled, and after a short space, by means of the continued twitching of the animal’s body, it was brought down in folds on the sides. The hinder

leg, first on one side and then on the other, was brought forward under the arm, which was pressed down upon it, and on the hinder limb being withdrawn, its skin was left inverted under the arm, and that of the fore leg was now loosened, and at length drawn off by the assistance of the mouth. The whole skin was thus detached, and was now pushed by the two hands into the mouth in a little ball, and swallowed at a single gulp."*

Accounts of Toads having been avowedly found enclosed in wood, stone, &c., are very numerous; but, unfortunately, the fact has never come sufficiently under the observation of scientific men to be properly accredited. The question, however, in our opinion, is by no means definitely settled. Experiments have been instituted by enclosing living Toads in various air-tight cells, and burying them; under which circumstances some have survived between one and two years. But such an experiment appears inconclusive, because the Toads being immured while active, their imprisonment was unnatural; if they had been enclosed when torpid, the results *might* not have been the same.

Pipa.†

Some Toads in South America, to which the above name is given, differ in form from ours, and still more remarkably in habits. The head is broad and triangular, and somewhat hog-like; the eyes

* Br. Rep. 110.

† Etymology unknown.

are small and close to the mouth; the body is wrinkled, and the toes of the fore feet terminate in four little rays. But the most singular point of their economy is, that the male takes the eggs as they are laid, and places them on the back of the female, to which they adhere: she at once goes to the water, the skin then swells, and breaks out into little cells, in which each egg is hatched, and in which the young dwell till they quit the tadpole state. The mother then, having rubbed off the old skin of her back, returns to the land. This species is called the Surinam Toad (*P. Surinamensis*).

Salamandra, the Salamanders.*

In form these animals resemble Lizards, but their skin is naked, and in their structure and economy they agree with the Frogs, passing through the same tadpole state in youth, and undergoing the same transformations. The gills of their early state appear externally in the form of tufts elegantly branched, and the fore feet are first formed. In their perfect form they have a long tail, generally flattened, and furnished in the aquatic kinds with a fin-like membrane above and below.

Some of them are terrestrial in their habits, residing in damp and dark places, under stones, in subterraneous caves, and old buildings, as the common Salamander of Europe, (*S. Maculosa*,) an animal of considerable size, black, with orange spots on the

* The Greek name of the genus.

sides. This is the species which by the ancients was invested with supernatural powers, classed with the Dragon and Basilisk, and, like them, feared and detested. It was, and is, reputed to be highly poisonous; but it appears that the charge is true only as regards a milky fluid that exudes from the skin, and which it can shoot to the distance of several inches: * this is caustic, nauseous, and fatal to small animals. The notion that it is able to resist the action of fire has been scouted in modern times, but what shall we say to the following anecdote, from no less a naturalist than the venerable Kirby? He gives it upon the authority of three ladies who witnessed the fact, and on whose accuracy he can rely:—"They were residing at Newbury, where their cellars were frequented by frogs, and a kind of newt, or Salamander, of a dull black colour. Several of the frogs were caught one day, and put into a pail; and while the ladies were looking at them, they were surprised by observing the frogs one after another turn themselves on their backs, and lie with their legs extended quite stiff and dead. Upon examining the pail, they found one of these efts, as they called them, running round very quickly amongst the frogs, each of which when touched by it died instantaneously in the manner above stated. They afterwards regarded these efts, as may be supposed, with nearly as much horror as they would a rattle-snake; and a few nights afterwards, finding one in the kitchen, it was seized with the tongs and

* Griffith's Cuv. vol. ix. p. 471.

thrown into a good fire which was burning in the grate. The reptile, instead of perishing, slipped like lightning through the coals, and ran away under the fire-place apparently unhurt. The house in which these animals were found was in a remarkably damp situation.”*

Of the Water-newts, (*Triton*† *Cristatus*, &c.,) we have three or four native species, common in ditches in spring: we have not room to detail their manners, which are much like those of Frogs.

Passing over some very large animals of the United States, resembling Salamanders, but in which no gills have been discovered at any period, we come to some, which, on the other hand, retain them through life.

Axolotus, ‡ the *Axolotl*.

This animal, about ten inches in length, has a considerable resemblance to the tadpole of a water newt: having branching gills proceeding from the under side of the head on each side. It does not part with these, nor undergo any transformation. It is found in the lake which surrounds the city of Mexico.

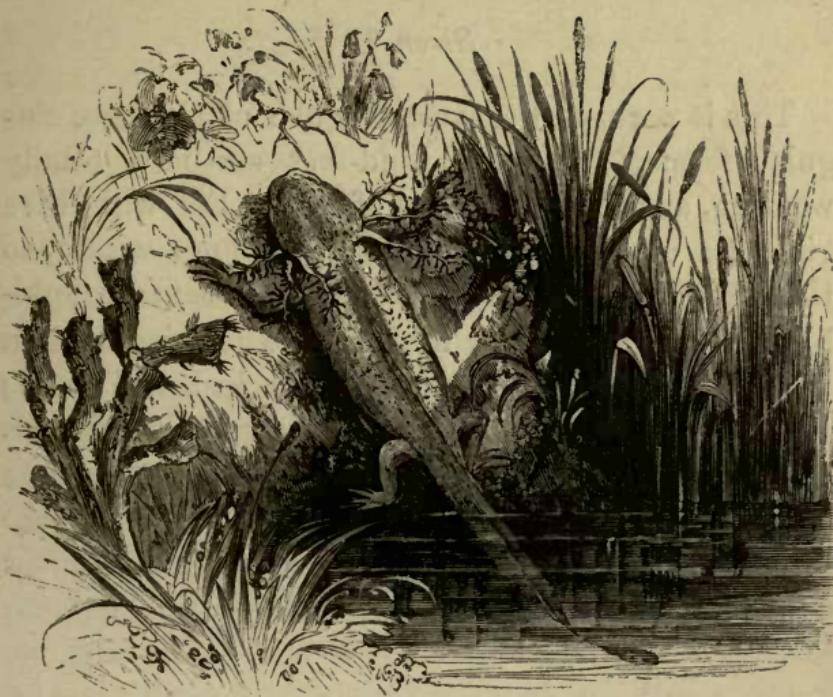
An animal much resembling this, but attaining the length of three feet, (*Menobranchus* § *Lateralis*,) is found in Lake Champlain.

* Instincts of Animals, Bridgewater Treatise, ii. p. 425.

† A marine demon in ancient mythology.

‡ From its Mexican name.

§ Μένω, *meno*, to remain, and βραγχία, *branchea*, gills.



THE AXOLOTL (*Axolotus Pisciformis*).

In lakes in certain caverns of Austria, which never saw the light of day, a singular animal has been found, the (*Proteus** *Anguinus*) which, to a slender body, a foot in length, joins four small legs. Its eyes are hidden by the skin, so that it is blind ; the general colour is almost white ; and it has in addition to real lungs, gills on each side of a bright coral-red. It appears to live on small shell-fish.

* The name of a fabled god, celebrated for his change of form.

*Siren.**

This is perhaps the most singular of all these singular forms. For the hind-feet are now totally wanting, and the form is that of a large Eel, with three gill-tufts on each side, and perfect lungs within, so that these two animals are in the true sense Amphibia, respiring in either medium. The Lizard Siren (*S. Lacertina*) is three feet long, blackish and slimy; found in the marshes of the Southern United States. It feeds on insects, worms, &c.

* A fabled monster of antiquity.

CLASS IV.—PISCES.*

IN all the preceding Classes, we have found many animals which are in a greater or less degree denizens of the water ; but all these have inhabited it merely as a supporting medium, the grand vital function of *respiration* being performed in the air. We now arrive at a very numerous and widely dispersed Class, which are in every sense aquatic, never coming to the surface to breathe, and, in fact, utterly incapable of respiring air. They breathe water ; and for this vital action they are provided with peculiar organs, instead of lungs ; viz. an apparatus called gills on each side of the neck, composed of a vast number of thin plates placed side by side in rows, suspended on bony arches ; these plates consisting of exceedingly minute but innumerable blood-vessels. The water taken in at the mouth, is ejected through the gills, and penetrating through these plates, and bathing every part of their surface, parts with a portion of its *oxygen*, which is thus communicated to the blood, as that of the air is communicated to the lungs of land animals. Thus the difference between aërial and aquatic respiration is not in its essential nature, but only in the medium by which the vivifying fluid is applied.

* *Piscis*, a Fish.

The first peculiarity that strikes an observer on comparing a Fish with almost any other *vertebrated* animal, is, the simplicity of its figure, the absence of those prominent limbs which form so large a part of others; the head, without any visible neck, merges into a more or less rounded tapering body, which terminates in a broad tail, in an almost unbroken outline, for the fins are generally so slight and membranous in their texture as scarcely to diminish this unity of form. Placed in a fluid of very nearly the same weight as itself, the Fish needed not the stout legs of the Quadruped, nor the long wings of the Bird. In order to rise, or descend at pleasure, most Fishes are provided with a long air-bladder in the upper part of the belly, by the compression or relaxation of which the body is made heavier or lighter than the surrounding water. The great organ of progression is the tail, which is thick and muscular, and being dilated by a broad finny expansion in a vertical direction, strikes the water to the right and left alternately with great power, as a single oar is used in the common operation of *sculling* a boat. The use of this organ as a rudder to change the direction is of course obvious. The *pectoral*, or breast fins, and the *ventral* or belly fins, likewise contribute to progressive motion, when the impulse is intended to be slight and short; but their chief use seems to be the balancing of the body: although it is certain that they represent, the former, the fore-limbs, and the latter (notwithstanding their position) the hind limbs of higher animals. The

external portion of these organs consists usually of a varying number of slender rays, on which a thin membrane is stretched. A fin formed in the same manner, called the *dorsal*, generally runs down the back, and another, the *anal*, is near the vent. The covering of fishes seems most to resemble that of the Serpents, but differs widely from it. It consists of scales, often delicately sculptured and beautifully transparent, usually overlapping each other at the edge.

The following eloquent passage from Cuvier's Ichthyology, sums up in a few words the most important peculiarities of this Class of animals : "Being aquatic, that is to say, living in a liquid which is heavier, and offers greater resistance than air, their power of motion has been necessarily disposed and calculated for progression as well as for elevation, which is also accomplished by them with ease. Hence arises that form of body which offers least resistance, (the chief seat of muscular force residing in the tail,) the shortness and expansibility of their limbs, the membranes which support them, the smooth or scaly covering, and the total absence of hairs or feathers. Breathing only through the medium of water, their blood is necessarily cold, and their vitality, the energy of their senses and movements, are consequently less than in Mammalia and Birds. Their brain, therefore, or rather a composition similar to it, is proportionally much smaller, and the external organs of their senses are not of a nature to admit of powerful impressions. Fishes, in fact, are, of all

vertebrated animals, those which have the least apparent signs of sensibility. Having no elastic air at their disposal, they remain mute or nearly so, and all those sensations awakened or sustained by the voice remain unknown to them. Their eyes almost immovable, their bony and rigid countenance, their limbs deprived of the power of inflexion, and every part moving at the same time, deprive them of the faculty of varying their physiognomy, or expressing their emotions. Their ear, enclosed on every side by the bones of the skull, without external conch or internal labyrinth, and composed only of a sac and membranous canals, scarcely allows them to distinguish the most striking sounds: and, in fact, an exquisite sense of hearing would be of very little use to those destined to live in the empire of silence, and around whom all are mute. Their sight, in the depths of their abode, would be little exercised; if the greater number of the species had not, by the size of their eyes, been enabled to supply the deficiency of light; but even in these species, the eye scarcely changes its direction; still less can it change its dimensions, and accommodate itself to the distance of objects; its *iris* neither dilates nor contracts, and its *pupil* remains the same in every degree of light. No tear bathes this eye, no eyelid soothes or protects it; and in this Class it must be regarded as only a feeble representation of that beautiful, brilliant, and animated organ of the higher Classes of animals. Procuring food by swimming after a prey which itself swims with greater or less rapidity,

having no means of seizing this prey, but by swallowing it, a delicate sense of taste would have been useless to Fishes, had nature bestowed it on them. But their tongue, almost immovable, often bony, or armed with dentated plates, and only receiving a few slender nerves, demonstrates that this organ is as little sensible as it is little necessary. Smell, even, cannot be as continually exercised by Fishes as by animals which breathe air in a direct manner, and whose nostrils are unceasingly traversed by odoriferous vapours. Lastly, we come to the touch, which, on account of the surface of their bodies being encircled by scales, by the inflexibility of the rays of their limbs, and by the dryness of the membranes enveloping them, has been obliged, as it were, to seek refuge at the end of their lips ; and even these, in some species, are reduced to a dry and insensible hardness."

Fishes are almost universally carnivorous : rapine and murder are unceasing ; the stronger preying upon the weaker, who in their turn destroy their inferiors with unrelenting rapacity. With one or two exceptions, in which the eggs are hatched previously to expulsion, these tribes are oviparous, and do not generally take any care either of their eggs or young. Many species appear to attain a great longevity : a Pike taken in Prussia, in 1754, bore a ring which testified its having been put into the pond in 1487 ; so that it had lived at least 267 years ; how much longer is of course unknown. The power of emitting a bright phosphoric radiance in the dark is

possessed by many sea-fishes: the Sun-fish, (*Cephalus Mola*,) for example, is said to resemble an enormous globe of iron at a white heat, when seen at night many fathoms beneath the surface.

Fishes are separated into two grand divisions which may be termed Sub-classes. The Bony Fishes, which are by far the most numerous, and which more fully answer the description above given, have a bony skeleton; while the Cartilaginous Fishes, as their name implies, have the skeleton formed of cartilage in place of bone, are destitute of ribs, and in other respects seem subordinate to the former.

BONY FISHES.

ORDER I.—ACANTHOPTERYGII.*

A VAST majority of all known Fishes are contained in this Order, which is distinguished by the first rays of the dorsal fin, the first of the anal, and generally, one in the ventrals, being spinous. Sometimes instead of the first dorsal fin, there are only a few unconnected spines.

FAM. I.—PERCADÆ.†

In this large family, named after the common Perch, which may be considered as its representative, the body is more or less oblong; the scales generally hard and rough, with toothed edges; the gill covers (*opercula*) edged with saw-like teeth or spines; the mouth large; the jaws, the vomer, (or middle ridge of the palate,) and the palate, furnished with teeth; the fins always seven in number and sometimes eight; the colours often very ornamental; the flesh usually well flavoured and wholesome.

Many of the genera have the ventral or belly fins inserted under the pectorals: hence named Thoracic Perches.

* Ἀκανθα, *akantha*, a thorn, and πτερυξ, *pteryx*, a fin.

† Πέρκη, *perke*, a perch.

α. THORACIC* PERCHES.

Perca, the Perch.



THE PERCH (*Perca Fluviafilis*).

The true Perches, inhabitants of calm lakes and smoothly flowing rivers, have the fore gill-cover toothed, and the gill-cover spined; the tongue smooth and free; the gills have seven rays; the ventral fins have five soft rays; the dorsal fins are two, large and strong, with stout spines; the teeth very small and close, resembling the pile of velvet; scales large, and toothed at the edge. The colours are generally

* From *thorax*, the chest.

pleasing, often bright, disposed in bands across the back, or in vivid hues on the fins, so as to afford fine contrasts.

Our common River Perch (*P. Fluviatilis*) is one of the most beautiful of our native Fishes, especially when its colours possess the brilliancy of life, heightened by the soft transparency of a clear stream. The back is of a greenish olive, sometimes shining with the hue of the emerald, and interrupted by five broad transverse bands of deep brown; the under parts are of a pearly white, and the fins of a delicate vermillion. The strong spines of the dorsal fin are said to be a sufficient defence against the voracity of that finny tyrant, the Pike. The flesh is delicate, firm, and much esteemed. It is common throughout Europe and the west of Asia, and is believed to have been introduced into our waters at some remote period; an opinion rendered more probable, by the ease with which it is transported; for such is its tenacity of life, that it will survive a journey of sixty miles, packed in wet moss or straw.

The Perch is said to delight in lakes and slow streams, particularly when the water is clear, the bottom gravelly, and the margin fringed with over-hanging bushes. It is not considered a difficult fish to take with the rod, with various baits, the best however being the minnow. It is gregarious in its habits, swimming in shoals; many may therefore be taken in succession. It rarely exceeds a foot in length, and two or three pounds in weight; but Pennant mentions one caught in the Serpentine,

which weighed nine pounds. Several species, of considerable size and beauty, inhabit the immense Lakes of North America.

Labrax, the Sea Perch.*

This fish, one species of which, the Basse, (*L. LUPUS*), is common on our southern coast, is closely allied to the Perch, but differs in having scales upon the gill-covers, and very small close teeth on the tongue. The Basse was highly esteemed by the ancient Greeks and Romans, and is famed in their writings for its flavour, and for its cunning stratagems to escape when caught. It grows to a large size, having been taken nearly thirty pounds in weight, and three feet in length. Its colour is a chaste bluish grey, softening into silvery on the under parts.

Apogon,† the King-Mullet.

This singular generic name was given by Lacépède, from its supposed relationship with the true Mullets. The fish is remarkable for the large size of its scales, which very readily come off. The fore gill-cover has a finely toothed double edge. The Mediterranean species (*A. Rex Mullorum*) is beautifully coloured, being of a bright crimson, deepest on the back, where it is crossed by three patches of deep black. It is prized for the table, though only three or four inches in length.

* Its ancient Greek name.

† Ἀπόγονος, *apogonos*, a relative.

In several genera of this great family, there is but one dorsal fin, or rather the two are joined into one, there being no vacant space between, though the distinction is still marked between the spiny and the soft part.

*Serranus.**

This is a numerous genus, consisting of species remarkable for their vivid and beautiful hues. Their characters are nearly those of the true Perches, except the difference of the dorsal fin. The Lettered Serran (*S. Scriba*) is of a deep orange red, with crossing black bands and spotted fins: the head is most elaborately and elegantly marked with irregular narrow zigzag lines of rich azure blue on the red ground, assuming somewhat of the form of written characters. This beauty, however, disappears in death. Its flesh is valued in the Mediterranean, where it is found.

β. JUGULAR† PERCHES.

In this division the ventral fins are situated before the pectorals, or under the throat. We illustrate it by a single genus.

Uranoscopus,‡ the Star-gazer.

This is a most singularly shaped fish; the eyes are placed on the summit of the head, which is large and

* *Serra*, a saw.

† *Jugulum*, the throat.

‡ *Oὐρανὸς*, ouranos, heaven, and *σκοπεω*, skopeo, to view.

cubical; the mouth also opens in the same direction; a stout rough spine stands up from each side of the head. From the mouth issues a long narrow worm-like filament, which is made to project above the mud, while the fish lies concealed under it. Small fishes hastening to seize the supposed worm, are presently themselves seized and devoured. It has no air-bladder, and therefore is compelled to remain at the bottom. There is a species in the Mediterranean, (*U. Scaber*), which, notwithstanding its hideous deformity, is eaten. It is about a foot in length.

γ. ABDOMINAL* PERCHES.

This section comprises such as have the ventrals placed farther back than the pectorals. Among them Cuvier places

Mullus,† *the Surmullet*.

It is distinguished by the two dorsals being widely separated; by the large size of the scales, which are easily rubbed off; by the long soft filaments of the lower jaws; by having no teeth in the upper jaw, and no air-bladder. The Striped Surmullet (*M. Surmuletus*) is common in the Mediterranean; it is not unfrequently taken on our own southern shores. It is less than a foot in length, of a fine lively crimson; and is famous as being the "Mugil," of which the Roman epicures were so extravagantly fond, giving

* *Abdomen*, the belly.

† Its Latin name.

the most enormous prices for such as exceeded the usual weight, as “a three pound mullet.”* By a refinement of luxury, they were accustomed to have it exhibited to the guests in a glass vessel before the commencement of the feast, and killed in their presence, that their eyes might be gratified in beholding the flitting changes of its colours in the moments of dying; the rosy hue giving place to alternate flushings and paleness, till at length all faded into the dull tint of death.

FAM. II.—TRIGLADÆ.

Closely allied to the Perches in many points, this family has, however, distinctive characters in the head, which is singularly armed with hard angular and pointed plates; these which are particularly observable on the cheeks, are jointed to the fore-gill cover. An approach to this form is seen in the head of the Star-gazers.

Trigla,† *the Gurnard.*

This genus displays the above family character in greatest perfection; the head, which is large and square, has an enormous bony plate on the cheek, immoveably jointed to the fore-gill cover. The dorsal fins are two; three distinct rays at the base of the pectorals. Some of them utter singular sounds when

* “——laudas, insane, trilibrem

Mullum ;—” Hor. Sat. ii. 2. 33.

† Τρίγλα, *trigla*, the Greek name of the Mullet.

taken out of the water, which, in one species, the Red Gurnard, (*T. Cuculus*), is said to resemble the call of the Cuckoo. The Sapphirine Gurnard (*T. Hirundo*) is remarkable for its very large pectorals, almost like a butterfly's wings, the upper surfaces of which are of a brilliant blue. Both these species are caught on our own coasts, and are eaten.



ORIENTAL FLYING-GURNARD (*Dactylopterus Orientalis*).

Some of them, distinguished by the rays before the pectorals being increased in number, and united by a membrane into a supernumerary fin of greater length than the body, have the power of supporting themselves in the air for some seconds, in the manner of the true Flying-fish. A species (*Dactylo-*

*pterus** *Volitans*,) found in the Mediterranean, is about a foot in length: its long fins are beautifully marked with blue.

Gasterosteus,† the Stickleback.

This active and pugnacious little fish, well known to every truant schoolboy, is found not only in all our rivers and brooks, but even in the sea all around our coast. They are of small size, the dorsal spines free, and not forming a fin, the body armed with bony plates; the ventral is merely a single spine; the gill rays are three. About half-a-dozen species are found in our waters, of which the Rough-tailed Stickleback (*G. Trachurus*‡) is one of the smallest, as well as most abundant. So numerous are they, that in some parts of the country they are used to manure the land. Pennant states that a single man has taken for this purpose nearly a hundred bushels a day, for a considerable time. A correspondent of the Magazine of Natural History, has given an amusing relation of their habits, when put into a tub of water. "When a few are first turned in, they swim about in a shoal, apparently exploring their new habitation. Suddenly one will take possession of a particular corner of the tub, or, as it will sometimes happen, of the bottom, and will instantly commence an attack upon his companions; and if any one of them ventures to oppose his

* Δάκτυλος, *daktylos*, a finger, and πτερόν, *pteron*, a wing.

† Γαστρὶ, *gaster*, the belly, and, ὄστεον, *osteon*, a bone.

‡ Τραχὺς, *trachys*, rough, and ὄυρα, *oura*, the tail.

sway, a regular and most furious battle ensues ; the two combatants swim round and round each other with the greatest rapidity, biting and endeavouring to pierce each other with their spines, which on these occasions are projected. I have witnessed a battle of this sort which lasted several minutes before either would give way ; and when one does submit, imagination can hardly conceive the vindictive fury of the conqueror ; who, in the most persevering and unrelenting way, chases his rival from one part of the tub to another, until fairly exhausted with fatigue. They also use their spines with such fatal effect, that incredible as it may appear, I have seen one, during a battle, absolutely rip his opponent quite open, so that he sank to the bottom and died. I have occasionally known three or four parts of the tub taken possession of by as many other little tyrants, who guard their territories with the strictest vigilance, and the slightest invasion invariably brings on a battle. These are the habits of the male fish alone ; the females are quite pacific ; appear fat, as if full of roe ; never assume the brilliant colours of the male, by whom, as far as I have observed, they are unmolested.”*

FAM. III.—SCIÆNADÆ.

This family much resembles the Perches, but has no teeth in either the vomer or the palate, and the head assumes a rounder form.

* Vol. III. p. 329.

*Sciæna.**

We know so little of the habits and manners of fishes, from our inability to penetrate into their recesses, that it is almost impossible to make their history popularly interesting; of many families we can give little more than the distinctive characters which mark the relations of one to the other, the connexion, so to speak, of the links which form the mighty chain, selecting for illustration, where we can, such as are remarkable for their size, beauty, or other peculiarities. The present genus, well known to the ancients, and esteemed by them, has the dorsals slightly separated; and but for the deficiency in the teeth mentioned above, would hardly be distinguished from Perches. One species, the Maigre of the French, (*S. Aquila*), attains a length of six feet; another, the Bearded Umbrina, (*S. Cirrosa*), is marked with very regular diagonal streaks of steel blue on a golden ground.

FAM. IV.—SPARIDÆ.

As in the preceding, the palate is destitute of teeth, and the scales are large: but the head is not rounded, nor is the gill-cover indented or spined: the gill rays are not more than six.

* The Greek name of the fish.

Sparus, the Sea-Bream.*

The jaws are furnished with several rows of round molar teeth resembling pavement; with pointed incisors in front. Many of them, as the Gilt-head, (*S. Auratus,*) are remarkable for the golden-coloured band which passes over the head, between the eyes. From the form of their teeth, they appear to be partly herbivorous, feeding on sea-weed.

The Sea-Bream of our southern coast (*Pagellus Centrodonus†*) is rather a fine fish, silvery, with a rosy, and sometimes a golden, gloss. Mr. Yarrell says of it, “The Sea-Bream is not highly esteemed for the table, and is not at all in request when salted; hence, when abundant, I have known it sold at so low a rate as two shillings and sixpence the hundred weight! When at the sea-coast on fishing excursions, it has been one of my customs to eat of the various fishes I could either catch or purchase, that are not in general use for the table. With the example of Isaac Walton before me, I will venture to suggest a mode of preparing Sea-Bream which materially improves its more ordinary flavour. When thoroughly cleaned, the fish should be wiped dry, but none of the scales should be taken off. In this state it should be broiled, turning it often, and if the skin cracks, flour it a little to keep the outer case entire. When on the table the whole skin and scales turn off without difficulty; and the muscle beneath, saturated with its own natural juices,

* Its Latin name.

† Κεντρον, *kentron*, a spur, and ὀδούς, *odous*, a tooth.

which the outside covering has retained, will be found of good flavour.”*

FAM. V.—MÆNIDÆ.

A few species are separated from the preceding, by Cuvier, to form this family, marked by the upper jaw being capable of protrusion and retraction. Some of them have teeth very fine and dense on the vomer.

FAM. VI.—CHÆTODONTIDÆ.

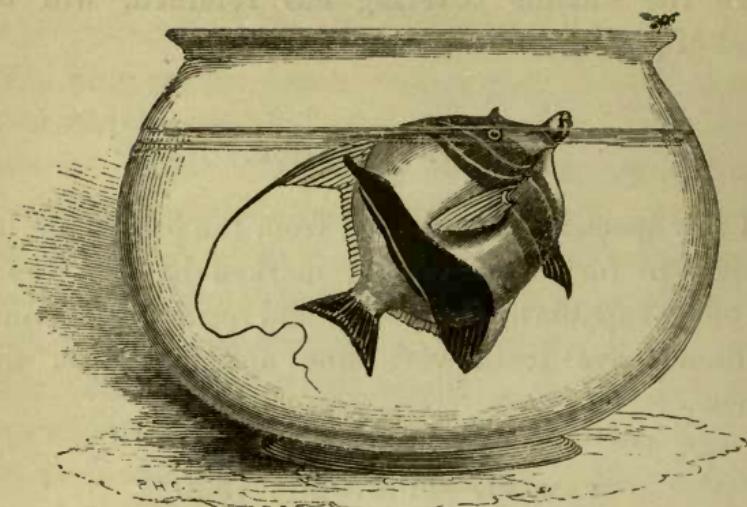
These have their dorsal and anal fins more or less covered with scales, so that they are not readily distinguished from the body. Their form is short, but deep and much compressed; in some the mouth projects into a sort of snout, and the fins of some run off into slender filaments of great length. Many of them are adorned with the most vivid and highly contrasted colours.

Chætodon. †

This genus consists principally of tropical species, remarkable for their beautiful colours, chiefly black and yellow, arranged in perpendicular bands. Their teeth resembling long and slender bristles, are collected in close rows, like the hairs of a brush. They

* Brit. Fishes, Vol. I. p. 109.

† Χαίτη, *chaite*, a bristle, and ὀδούς, *odus*, a tooth.



HORNED CHÆTODON (*Ch. cornutus*).

frequent rocky shores, and are good food. Freycinet, in his Voyage round the World, records that, in wading over the coral-reefs at the Island of Guam, in search of Mollusca, he was assailed by a very small Chaetodon, not bigger than his hand: it butted at his hand, and pertinaciously refused to be driven away. Some species, *C. Rostratus* for example, have the snout lengthened into a tube, open only at the end, which is applied to an extraordinary use, that of shooting flies! The fish approaches under a fly which it has discovered, resting on a leaf or twig, a few feet above the water, taking care not to alarm it by too sudden a motion; then, projecting the tip of its beak from the surface, it shoots a single drop at the insect with so clever an aim, as very rarely to miss it, when it falls into the water and is devoured. Being common in the Indian seas, it is often kept

by the Chinese in vases, as we keep Gold-fishes, for the amusement of witnessing this feat. A fly is *fastened* at some distance, at which the fish shoots, but, disappointed of course, and wondering that its prey does not fall, it goes on to repeat the discharge for many times in succession, without seeming to take in a fresh stock of ammunition, and scarcely ever missing the mark, though at a distance of three or four feet.*

FAM. VII.—SCOMBRIDÆ.

This rather extensive family is among the most useful to man, from the large size which many of them attain, the delicate flavour and nutritious quality of their flesh, and their immensely swarming fertility, affording occupation to thousands of hardy and industrious men in their capture and sale. Most of them are distinguished for the elegance of their shape, generally tapering to a point at each extremity, and thickening with a graceful curve to the middle. They have a smooth body, with small and close scales, and a tail possessed of great breadth and power.

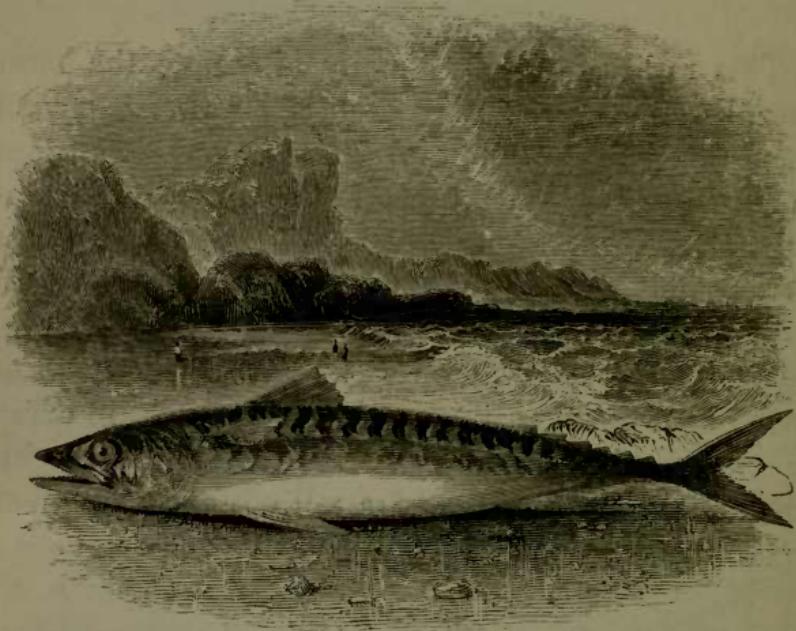
Scomber,† *the Mackarel.*

Few fishes are more worthy of admiration than the Mackarel, whether we regard the chaste and

* See Phil. Trans. pp. 110, 321.

† Σκομβρός, *skombros*, the Greek name of the genus.

elegant pencilling of its changing hues, or the flavour, solidity, and wholesomeness of its flesh. As a genus, its character consists in the second dorsal, as well as the anal fin, being cut, as it were, into several smaller fins detached from one another. In common with many other subjects of our most important fisheries, the Mackarel (*S. Scomber*) was formerly believed to perform long migrations, from shore to shore, in immense shoals of countless mil-



THE MACKAREL (*Scomber Scomber*).

lions; but their periodical appearance on our coast is now pretty well ascertained to be, not their arrival from distant seas, but merely their removal from the deep water of the offing, a few miles distant at most,

into the shallow water of the shore, where they may deposit their spawn within reach of the sun's light and heat. "It is probable," observes Mr. Yarrell, "that the Mackarel inhabits almost the whole of the European seas; and the law of nature, which obliges them and many others to visit the shallower water of the shores at a particular season, appears to be one of those wise and bountiful provisions of the Creator, by which not only is the species perpetuated with the greatest certainty, but a large portion of the parent animals are thus brought within the reach of man, who, but for the action of this law, would be deprived of many of those species most valuable to him as food."

We avail ourselves of the same interesting work to add a few more particulars of the history of this fish. "In May, 1807, the first Brighton boat-load of Mackarel sold at Billingsgate for forty guineas per hundred,—seven shillings each, reckoning six score to a hundred, the highest price ever known at that market. The next boat-load produced but thirteen guineas per hundred. Mackarel were so plentiful at Dover in 1808, that they were sold sixty for a shilling. At Brighton, in June of the same year, the shoal of Mackarel was so great, that one of the boats had the meshes of her nets so completely occupied by them, that it was impossible to drag them in; the fish and nets, therefore, in the end, sunk together, the fishermen thereby sustaining a loss of nearly 60*l.*, exclusive of what the cargo, could it have been got into the boat, would

have produced. The success of the fishery in 1821 was beyond all precedent. The value of the catch of sixteen boats from Lowestoffe, on the 30th of June, was 5252*l.*; and it is supposed that there was no less an amount than 14,000*l.* altogether realized by the owners and men concerned in the fishery of the Suffolk coast. In March, 1833, on a Sunday, four Hastings boats brought on shore ten thousand eight hundred Mackarel; and the next day two boats brought seven thousand fish. Early in the month of February, 1834, one boat's crew from Hastings cleared 100*l.* by the fish caught in one night; and a large quantity of very fine Mackarel appeared in the London market in the second week of the same month: they were cried through the streets of London three for a shilling on the 14th and 22nd of March, 1834, and had then been plentiful for a month.

“The boats engaged in fishing are usually attended by other fast-sailing vessels, which are sent away with the fish taken. From some situations these vessels sail away direct for the London market; at others, they make for the nearest point from which they can obtain land carriage for their fish. From Hastings and other fishing towns on the Sussex coast the fish are brought to London by vans, which travel up during the night.”

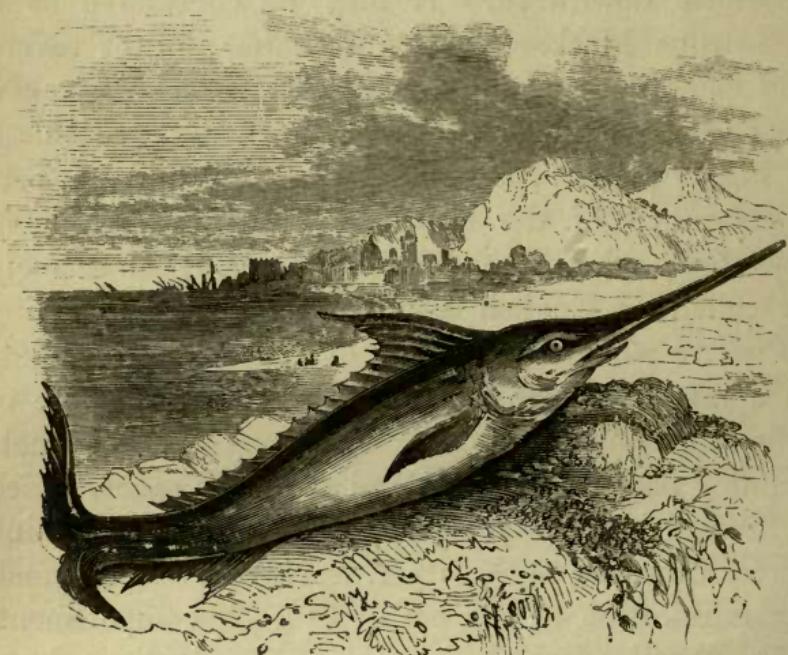
We are constrained to refer the reader to Mr. Yarrell's own account of the mode in which the Mackarel fishery is carried on upon our coast, merely observing, that it is by drift nets of great dimen-

sions, corked but not leaded, sometimes extending in united length to more than a mile. They are shot in the line of the wind, and are kept tight by the fishing-boat riding from the leeward end, as from her anchor.

To this genus belongs the Tunny, (*S. Thynnus*), often mentioned with honour by the ancients from Aristotle downward. It may be considered as a monstrous Mackarel, often reaching six or seven, and sometimes even nine feet. A specimen taken near Greenock, in 1831, was of this length. Its flesh is highly prized, but, from its great solidity, it partakes much of the character of meat. Although repeatedly taken on the English coast, it can scarcely be called an English fish, the Mediterranean being its native sea. On the coast of Italy, they are taken in a manner which reminds one of the capture of wild Elephants in Ceylon. Two long and deep nets running parallel to the shore enclose a space, which is divided into square compartments by nets running across from one to the other, leaving however a small communication at one corner of each compartment. The Tunnies, which in their peregrinations keep close alongshore, pursue their way between the inner net and the land, but on coming to the end they are stopped by a net which passes from the great machine to the shore; turning, they enter the first chamber by a passage left for the purpose, and are gradually driven from one to the other until they reach the last. Here they are killed with much clamour and mirth by men who surround the nets,

striking the huge fish with poles. Numbers of the higher classes find great amusement in witnessing this spectacle ; and Louis XIII. declared it was the pleasantest sight he had seen in his whole visit to the south.

Xiphias, the Swordfish.*



COMMON SWORDFISH (*Xiphias Gladius*).

The far-famed Swordfish is remarkable for the great width and strength of its tail, to which there was an approach in that of the Mackarel, and still more in that of the Tunny. But a more obvious peculiarity is the extension of the upper jaw into a long

* Its Greek name, from *ξίφος*, *xiphos*, a sword.

bony spear of great hardness, and which is a most formidable offensive weapon. From the great volume and muscular force of the tail, their swiftness is very great, and gives an impetus to the thrust of their "sword" that nothing can resist. Instances have been numerous in which the copper, plank, and timbers, of ships have been deeply pierced by the snout of a Swordfish,—a feat requiring a most astonishing force. It has been supposed, and not without reason, that these suicidal assaults are the results of a want of discrimination, the fish mistaking the great hull of a vessel for the body of a whale, to which it is said to entertain the most rancorous hostility. "One morning," says Captain Crow, in a recent voyage to Memel, "during a calm, when near the Hebrides, all hands were called up at three A.M. to witness a battle between several of the fish called Thrashers, or Fox Sharks, (*Carcharias Vulpes,*) and some Swordfish on one side, and an enormous Whale on the other. It was in the middle of summer, and the weather being clear, and the fish close to the vessel, we had a fine opportunity of witnessing the contest. As soon as the Whale's back appeared above the water, the Thrashers, springing several yards into the air, descended with great violence upon the object of their rancour, and inflicted upon him the most severe slaps with their long tails, the sound of which resembled the reports of muskets fired at a distance. The Swordfish, in their turn, attacked the distressed Whale, stabbing from below; and thus beset on all sides and wound-

ed, when the poor creature appeared the water around him was dyed with blood. In this manner they continued tormenting and wounding him for many hours, until we lost sight of him ; and I have no doubt they, in the end, completed his destruction.”* The species thus alluded to is doubtless the *X. Gladius*, a native of the Mediterranean and Atlantic, which sometimes attains the length of fifteen feet. Its flesh is said to be hard, but good and nourishing.

Naucrates,† *the Pilot-fish.*

A single dorsal fin, before which, as well as before the anal, there are a few free small spines, and a ridge on the sides of the tail, are the distinctive marks of this genus. The single species recognized (*N. Ductor*) is well known to seamen from its constant attendance on the White Shark, (*Carcharias Vulgaris*,) to which it evidently acts, strange and unaccountable as it undoubtedly is, as a guide to food. Cuvier asserts, that “it follows ships to seize on what may fall from them ; and as a similar habit is observed in the Shark, it has been said that the former acts as guide or pilot to the latter,” but this is a very summary mode of removing the difficulty. The author of this work has had several opportunities of observing the connexion, and never without admiration and surprise. Though, during a long calm in a voyage to the Gulf of Mexico, as well as

* Memoirs of Capt. H. Crow, p. 11.

† Ναυκράτης, naukrates, a pilot.

before and after, these hateful fishes were perpetually stealing round the ship, he does not recollect ever having seen a Shark of any considerable size, without one or more of these Pilots attending him. This little creature generally keeps his station just over the head of the Shark, but sometimes over one of the pectoral fins, within an inch or two of his body, turning when he turns, stopping when he stops, and never leaving him, except to swim a-head to examine some bait. Having examined it, he instantly returns and resumes his place. It would really appear as if some communication took place between them, for the Shark, who before seemed quite unaware of the proximity of any food, on the return of the Pilot-fish instantly quickens his motion, and bustles towards it. But an instance still more conclusive is recorded in Griffith's Cuvier, furnished by Col. Hamilton Smith. "Captain Richards, R.N., during his last station in the Mediterranean, saw on a fine day a Blue Shark, which followed the ship, attracted perhaps by a corpse which had been committed to the waves. After some time a shark-hook, baited with pork, was flung out. The Shark, attended by four Pilot-fish, repeatedly approached the bait; and every time that he did so, one of the Pilots preceding him was distinctly seen from the taffrail of the ship to run his snout against the side of the Shark's head to turn it away. After some farther play, the fish swam off in the wake of the vessel, his dorsal fin being long distinctly visible above the water. When he

had gone, however, a considerable distance, he suddenly turned round, darted after the vessel, and before the Pilot-fish could overtake him and interpose, snapped at the bait and was taken. In hoisting him up, one of the Pilots was observed to cling to his side until he was half above water, when it fell off. All the Pilot-fishes then swam about awhile, as if in search of their friend, with every apparent mark of anxiety and distress, and afterwards darted suddenly down into the depths of the sea. Col. H. Smith has himself witnessed, with intense curiosity, an event in all respects precisely similar.”*

Passing by many genera that are not destitute of interest, we notice, before quitting this family, the genus

Coryphæna,†

probably so named on account of the compressed form of its body, being much deeper than broad; the upper part of the head even runs in a sharp ridge; the dorsal extends along the whole body. They are universally, though erroneously, called *Dolphins* by our sailors, and are famed for their reputed changes of colour when dying. We have had an opportunity of witnessing the death of one *Coryphène*, (*C. Psittacus*?) whose changes were not exactly what are generally believed to take place. We had

* Anim. Kingd. vol. x. p. 636.

† Κορυφαῖος, *koryphaios*, vertical?

expected that, as it died, opaline flashes would fleet over the skin, but what really occurred was this: when brought out of the water, it was silvery grey with pearly reflections, but in a few minutes after it had lain on deck, the whole body *suddenly* changed to a brilliant green, (a permanent, not an iridescent colour,) the back dark, the belly yellower, almost like gold, with blue spots; this was the only change, except that the hue became more dingy after death. Alive, and in their native element, they are very beautiful; generally appearing (judging from our own observation) in parties of five or six, they would play around, sometimes at the surface, and then far down in the clear depths below. When they turn in the water, their backs are dark one moment, and the next gleam like polished silver, or mother-of-pearl. These are among the cruel enemies of the little Flying fish.

FAM. VIII.—TÆNIADÆ,* RIBBON FISHES.

The members of this small family are much lengthened, and flattened on the sides; they have small scales. Some of the genera of the last family, which we were compelled to overlook, manifest an approximation to this form.

Lepidopus,† the Garter-fish.

The ventrals are represented by two small scales

* *Tænia*, *tainia*, a ribbon.

† *λεπίς*, *lepis*, a scale, and *πούς*, *pous*, a foot.

or plates ; the dorsal extends over the whole body ; the anal is close to the tail ; teeth cutting and pointed ; gill rays eight. The Garter, or Scabbard fish, (*L. Argyreus*,*) inhabits the Atlantic from our own shores to the Cape of Good Hope ; it is six feet long, of a bright smooth silvery hue, and apparently without scales. The flesh is sometimes eaten.

FAM. IX.—THEUTIDÆ.

A few foreign genera are contained in this family, of which little is known : they shew a relation to the Mackarels in some particulars, as the ridge on the tail, &c. They have a single dorsal ; teeth, on the jaws only, trenchant ; mouth not protractile ; body flattened sidewise. They feed chiefly on seaweeds. The genus *Siganus*† is remarkable for a spinous ray on each side of the ventrals, a thing unexampled elsewhere. *Acanthurus*‡ has the tail furnished with moveable spines resembling lancets on each side, which inflict severe wounds.

FAM. X.—ANABANTIDÆ. §

The bones of the *pharynx*, or throat, are here divided into a great number of small and thin plates of irregular form, forming small cells, in which they

* Ἄργυρεος, *argyros*, silver.

† A native name.

‡ Αναύθα, *akantha*, a thorn, and οὐρά, *oura*, the tail.

§ Ἀναβαίνω, *anabaino*, to ascend.

retain water for some time to moisten the gills when out of water, many of the species having the singular faculty of quitting their native element, and crawling about to a considerable distance. From their being thus found in dry situations, the natives of the Indian coasts believe them to fall from heaven. The Snakeheads (*Ophicephalus**) in particular are noted for this peculiarity, being often exhibited by the Indian jugglers, and made to crawl for the amusement of spectators.

FAM. XI.—MUGILIDÆ.

The Grey Mullets (*Mugil* †) have a cylindrical body, clothed with large scales; two dorsals wide apart; ventrals behind the pectorals; a head somewhat flattened, and an under lip rising to an angle in the middle, corresponding to a depression in the upper; six gill rays. Two or three species are taken on our own coast, and in our rivers, as they are fond of coming into the fresh water. This habit suggested the rearing of some young fry in fresh water wholly, an experiment which was perfectly successful, resulting in the superior size, weight, and fatness of the fish. Mr. Couch, as quoted by Mr. Yarrell, has given the habits of the commonest species, (*Mugil Capito*,) in a very interesting manner. “This fish never goes to a great

* ὄφις, ophis, a serpent, and κεφαλή, kephale, the head.

† *Mugil*, the Latin name of these fishes.

distance from land, but delights in shallow water when the weather is warm and fine; at which time it is seen prowling near the margin in search of food, and imprinting a dimple on the placid surface as it snatches beneath any oily substance that may chance to be swimming. It ventures to some distance up rivers, but always returns with the tide. Carew, the Cornish historian, had a pond of salt water, in which these fish were kept: and he says that, having been accustomed to feed them at a certain place every evening, they became so tame that a knocking like that of chopping would certainly cause them to assemble. The intelligence this argues may also be inferred from the skill and vigilance this fish displays in avoiding danger, more especially in effecting its escape in circumstances of great peril. When enclosed within a ground-sean or sweep-net, as soon as the danger is seen, and before the limits of its range are straightened, and when even the end of the net might be passed, it is its common habit to prefer the shorter course, and throw itself over the headline and so escape, and when one of the company passes all immediately follow.

“ This disposition is so innate in the Grey Mullet, that young ones of minute size may be seen tumbling themselves head over tail in their active exertions to pass the head-line. I have even known a Mullet, less than an inch in length, to throw itself repeatedly over the side of a cup in which the water was an inch below the brim.

“ Mullets frequently enter by the flood-gate into a salt-water mill-pool at Looe, which contains about twenty acres ; and the larger ones, having looked about for a turn or two, often return by the way they had come. When, however, the turn of the tide has closed the gates and prevented this, though the space within is sufficiently large for pleasure and safety, the idea of constraint and danger sets them on effecting their deliverance. The wall is examined in every part ; and when the water is near the summit, efforts are made to throw themselves over, by which they are not uncommonly left on the bank to their own destruction.

“ When, after being surrounded by a net, two or three have made their escape, and the margin of the net has been secured and elevated above the surface to render certain the capture of the only remaining one, I have seen the anxious prisoner pass from end to end, examine every mesh, and all the folds that lay on the ground, and at last, concluding that to pass through a mesh or rend it afforded the only, though desperate, chance of escape, it has retired to the greatest possible distance, which had not been done before, and rushed at once to that part which was most tightly stretched. It was held, however, by the middle, and conscious that all further effort must be unavailing, it yielded without a further struggle to its fate.

“ The Grey Mullet selects food that is soft and fat, or such as has begun to suffer decomposition, in search of which it is often seen thrusting its

mouth into the soft mud ; and, for selecting it, the lips appear to be furnished with exquisite sensibility of taste. It is indeed the only fish of which I am able to express my belief that it usually selects for food nothing that has life ; although it sometimes swallows the common sand-worm. Its good success in escaping the hook, commonly proceeds from its care not to swallow a particle of any large or hard substance ; to avoid which, it repeatedly receives the bait into its mouth and rejects it ; so that when hooked, it is in the lips, from which the weight and struggles of the fish often deliver it. It is most readily taken with bait formed of the fat entrails of a fish, or cabbage boiled in broth.”*

FAM. XII.—GOBIADÆ.†

In this family, the dorsal has thin and flexible spines, and there is no air bladder. The genera are usually invested with a slimy secretion.

Blennius,‡ the Blenny.

The narrow, two-rayed ventrals, situated in front of the pectorals, well distinguish this genus; added to which, the head is rounded and abrupt; the dorsals united into one; the body smooth and slimy. Some of the species, as the Viviparous Blenny, (*B.*

* Br. Fishes, i. p. 202.

† Κώβιος, *kobios*, the Greek name of some undetermined fish.

‡ Βλέννα, *blenna*, mucus.

Viviparus,) of the northern coasts of Europe, produce their young alive, which are active and able to provide their own sustenance as soon as born. The Butterfly fish (*B. Ocellaris*) is remarkable for a dark eye-spot, on the large dorsal fins.

A strong and ferocious fish, the Sea-wolf, or the Sea-cat (*Anarrhichas** *Lupus*) is closely related to the Blennies, but has no ventrals. Its mouth is well armed with strong pointed teeth, and its rounded head has a broad cat-like face, of very savage and sinister aspect, not at all belied by its rapacious propensities. It is common in the northern seas, and is often caught on the coast of Scotland, where it is found six or seven feet in length.

Callionymus,† the Dragonets.

In form, the Dragonets remind us of some of the Mail-cheeks, particularly the genus *Cottus*, the Sculpins, by which name, indeed, the present genus is sometimes called by the fishermen. The aperture of the gills is very small, on each side of the back of the head; the ventrals which are large, and not united, are placed under the throat; the mouth capable of protrusion; teeth small, on the jaws only; eyes on the top of the head; the fins are generally of large size. The Gemmeous Dragonet (*C. Lyra*) is a beautiful fish, having the body coloured with golden

† Ἀνὰ, *ana*, upward, and ἀρρίχας, *arrhichas*, holding on by the hands and feet; a name invented by Gesner, because this fish is said to climb by the aid of its fins and tail.

* Καλός, *kalos*, beautiful, and ὄνομα, *onoma*, a name.

yellow, striped and spotted on the head, with azure blue; the eyes are orange, with blue pupils. It is remarkable for the long arched spine of the first dorsal, which reaches to the tail. It is eaten, but is rare on our shores.

FAM. XIII.—LOPHIADÆ.

In this section are contained two or three genera of very singular form and habits, having the bones of the pectorals so lengthened, as to cause them to assume the form of jointed feet, and actually enabling them to crawl on land. Their position, however, far behind on the body, causes them to act as the hind feet, the ventrals, which are considered as representing the hind limbs, being placed near the throat; and they being palmated in form, have the use of fore-feet.

Lophius, the Fishing Frog.*

The gills in this singular genus are concealed from view, being covered with the common skin, but their situation is very perceptible during life; they do communicate with the water, however, by a small hole behind the foot-like pectorals. The head is enormously large and flattened; body, without scales, slender; gill-rays six. From the great size and shape of the head, as well as from their colours, which frequently take the form of spots, these fishes have

* Λόφος, *lophos*, a crest.

been compared to Frogs, and they have received the name of Fishes and Anglers, from another singular part of their economy. To an enormous stomach and mouth, they add an insatiable voracity, but being slow swimmers, they are provided with a very curious mode of taking their more active prey. On the top of their head are two slender erect processes, of considerable length, one of which is furnished with a flattened tip hanging down, of a bright silvery hue. These have great power and freedom of motion, at the will of the animal. "While couching close to the ground, the fish by the action of its ventral and pectoral fins, stirs up the sand or mud; hidden by the obscurity thus produced, it elevates these appendages, moves them in various directions by way of attraction as a bait, and the small fishes approaching either to examine or to seize them, immediately become the prey of the Fisher."* Mr. Couch observes, of our common Angler, (*L. Piscatorius*), "It makes but little difference what the prey is, either in respect of size or quality. A fisherman had hooked a cod-fish, and while drawing it up, he felt a heavier weight attach itself to his line; this proved to be an Angler of large size, which he compelled to quit its hold, by a heavy blow on its head, leaving its prey still attached to the hook. In another instance, an Angler seized a Conger Eel that had taken the hook; but after the latter had been engulphed in the enormous jaws, and perhaps stomach, it struggled through the gill-aperture of the

* Yarrell.



MARBLED ANGLER (*Antennarius Marmoratus*)?

Angler, and in that situation, both were drawn up together. I have been told of its swallowing the large ball of cork employed as a buoy to a bulter, or deep-sea-line; and the fact this implies of its mounting to the surface, is further confirmed by the evidence of sailors and fishermen, who have seen it floating, and taken it with a line at mid-water.*" The writer of the present work once found a very young individual (*Antennarius* † *Marmoratus* ?) swimming about the floating weed in the Gulf Stream; it was not more than an inch in length, but fully formed and very active, pushing itself with its jointed fins through the tangled stalks of the weed, and crawling like a quadruped. The projection or

* Yarrell's Br. Fishes, Vol. I. p. 272.

† *Antennæ*, the horn-like appendages of an insect.

the head, took the form of a stout horn, with several free filaments at the end. These fishes in tropical climates, are said frequently to forsake the water, and live two or three days on land. They have a habit of filling their immense stomachs with air, thus blowing themselves up into a globular form, like a balloon. Some of them attain a large size, our common Angler, mentioned above, sometimes being found five feet in length.

FAM. XIV.—LABRIDÆ.

The members of this family are recognized by their oblong body, covered with large scales; a single dorsal, partly spinous, and partly flexible; remarkably thick fleshy lips; strong teeth varying in form; and a strong air-bladder.

Labrus, the Wrasse.*

This is an extensive genus, strongly marked, and readily distinguished by the family characters given above; the teeth of the jaws are sharp, but those of the throat resembling little paving stones; cheek and gill-cover scaled; gill-rays five. The Wrasses are generally noted for their bright and beautiful colours, often arranged in stripes or other variegations; their beauty is greatest, just previous to spawning. Their flesh is not in high estimation.

We have several native species, but we prefer to

* *Labrum*, a lip

illustrate the genus by a little species, (*L. Auritus*), common in the North American rivers, whose manners are in so amusing a manner detailed by Audubon. It is there called the Sun-Perch, is about five inches in length, usually of an olive hue, sometimes varying to a paler tint, and occasionally shining with a coppery gloss. It delights in clear and shallow waters, where it can be exposed to the sun's influence. "The golden hues of some parts of the body blend with the green of the emerald, while the coral tints of the lower parts, and the red of its sparkling eye, render our little favourite a perfect gem of the water." But it is chiefly remarkable for its parental assiduity in forming and watching a nest; an instinct, which though not quite unparalleled, is certainly very unusual among Fishes. "The Sun-Perch," says this engaging writer, "wherever found, seems to give a decided preference to sandy, gravelly, or rocky beds of streams, avoiding those of which the bottom is muddy. At the period of depositing their eggs, this preference is still more apparent. The little creature is then seen swimming rapidly over shallows, the bed of which is mostly formed of fine gravel, when, after a while, it is observed to poise itself, and gradually sink to the bottom, where, with its fins, it pushes aside the sand to the extent of eight or ten inches, thus forming a circular cavity. In a few days, a little ridge is thus raised around, and in the cleared area the roe is deposited. By wading carefully over the extent of the place, a person may count forty, fifty, or

more of these beds, some within a few feet of each other, and some several yards apart. Instead of abandoning its spawn, as others of the family are wont to do, this little fish keeps guard over it with all the care of a sitting bird. You observe it poised over the bed, watching the objects around. Should the rotten leaf of a tree, a piece of wood, or any other substance, happen to be rolled over the border of the bed, the Sun-fish carefully removes it, holding the obnoxious matter in its mouth, and dropping it over the margin. Having many times witnessed this act of prudence and cleanliness in the little Sunny, and observed that at this period it will not seize on any kind of bait, I took it into my head one fair afternoon to make a few experiments for the purpose of judging how far its instinct or reason might induce it to act when disturbed or harassed.

"Provided with a fine fishing-line, and such insects as I knew were relished by this fish, I reached a sand-bar, covered by about one foot of water, where I had previously seen many deposits. Approaching the nearest to the shore with great care, I baited my hook with a living ground worm, the greater part of which was left at liberty to writhe as it pleased, and throwing the line up the stream, managed it so that at last it passed over the border of the nest, where I allowed it to remain on the bottom. The fish, I perceived, had marked me, and as the worm intruded on his premises, he swam to the farther side, there poised himself for a few moments, then approached the worm and carried it in his

mouth over the next side to me, with a care and gentleness so very remarkable, as to afford me much surprise. I repeated the experiment six or seven times, and always with the same result. Then, changing the bait, I employed a young Grasshopper, which I floated into the egg-bed. The insect was removed, as the worm had been, and two attempts to hook the fish were unsuccessful. I now threw my line with the hook bare, and managed as before. The Sunny appeared quite alarmed. It swam to one side, then to another, in rapid succession, and seemed to entertain a fear that the removal of the suspicious object, might prove extremely dangerous to it. Yet it gradually approached the hook, took it delicately up, and the next instant dropped it over the edge of the bed.

“Satisfied that at this period, the Sun-fish was more than a match for me, I rolled up my line, and with my rod gave a rap on the water, as nearly over the fish as I could. The Sunny darted off to a distance of several yards, poised itself steadily, and as soon as my rod was raised from the water, returned to its station. The effect of the blow on the water, was now apparent; for I perceived that the fish was busily employed in smoothing the bed: but here ended my experiments on the Sun-fish.”*

To this family belongs a genus of fishes, (*Scarus*,†) numerous in the seas of the tropics, and for the most part distinguished by the splendour of their

* Orn. Biog. Vol. iii. p. 50.

† Σκάρος, *skaros*, its ancient Greek name.

hues, whence they are called Parrot-fishes. One species (*S. Creticus*) was so highly esteemed by the ancients, that the commander of a Roman fleet went to Greece, expressly to procure it alive, that he might distribute it in the Italian seas.

FAM. XV.—FISTULARIADÆ.

The bones of the skull are lengthened in this family into a long and slender tube, at the end of which is placed the mouth, composed of the usual bones ; the ribs are either very short, or else entirely wanting.

Fistularia, the Pipe-fish.*

The name of this first genus, is obviously derived from the peculiarity already mentioned, as distinguishing the family. The body is long and slender, the dorsals two, the first with spines ; from the centre of the tail fin proceeds a very long filament ; the air-bladder very small, and the scales imperceptible. They inhabit the seas of Tropical regions, feeding on small crustaceous animals. The Bellows-Fish (*Centriscus Scolopax*)† sometimes taken on the British coast, belongs to this family. It is distinguished from the Pipe-fishes, by the body being shorter and oblong, the belly coming to an edge ;

* *Fistula*, a pipe or flute.

† *Kέντρον*, kentron, a spur ; *scolopax*, a snipe, from the beak-like mouth.

and by wanting the long tail filament. It is moreover but a few inches in length.

This family closes the first Order of Bony Fishes, viz., those with spinous rays to the fins.

Another large section of Bony Fishes consists of those whose fins, destitute of spines, are supported by soft and flexible rays, either jointed or branched, or sometimes both. This Division, termed Malacopterygii,* comprises three Orders, named from the presence and position of the ventral fins.

* Μαλακός, *malakos*, soft, and πτερυξ, *pteryx*, a fin.

ORDER II.—ABDOMINAL MALACOPTERYGII.

The fishes of this Order have the ventrals situated under the belly, behind the pectorals, and not attached to the bones of the shoulder. It is a numerous Order, including most of the fresh-water Fishes, and some marine ones also.

FAM. I.—CYPRINIDÆ.

A mouth but slightly cleft; weak jaws, usually destitute of teeth; strong teeth in the throat; few gill rays; and a body well covered with scales, are the more obvious distinctions of this family.

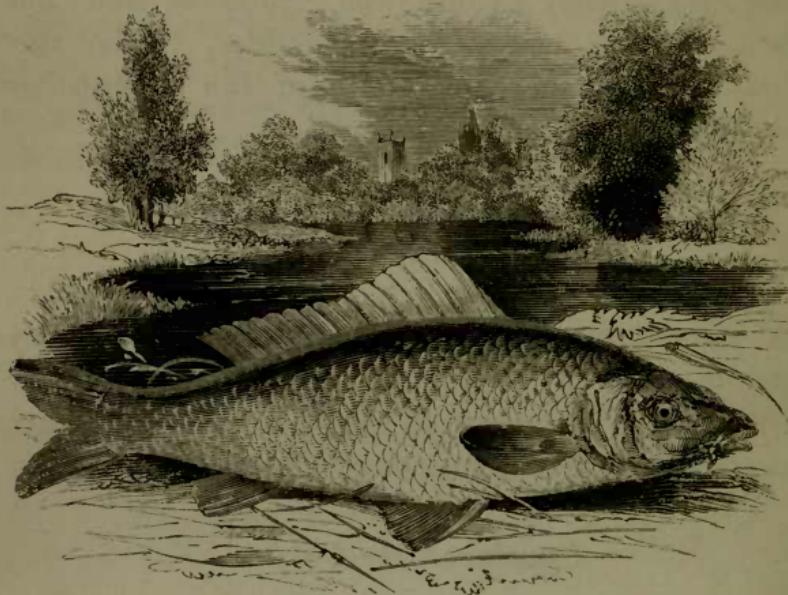
Cyprinus, the Carp.*

The Carps are a large genus, widely dispersed in the fresh-waters of both Continents. They have but one dorsal fin; the scales are usually large; the tongue is smooth; and there is on the palate a thick, soft, and singularly irritable substance, called "a Carp's tongue." The want of teeth in the jaws is compensated by the powerful teeth of the throat, adapted to masticate and grind the food; the more

* From the Island of Cyprus?

necessary, as that food consists of seeds and other vegetable matters. The gills have three rays.

The Common Carp (*C. Carpio*), which old Izaak Walton calls “the queen of rivers, a stately, a good, and a very subtil fish,” is not a native of England, but was introduced from the south of Europe,



THE CARP (*Cyprinus Carpio*).

where it was well known to the ancient naturalists. It is now, however, pretty common in the southern portion of this island, though it is still almost unknown in Scotland. This must be owing to its susceptibility of cold, for it is exceedingly prolific, as many as seven hundred thousand ova having been found in the roe of a single Carp. They are,

according to Cuvier, “perhaps the least carnivorous of all fishes;” feeding principally on river weeds, varied, however, occasionally with insects and worms. They appear to be torpid in winter, concealing themselves in the mud. Gilbert White writes,—“In the garden of the Black Bear Inn, in the town of Reading, is a stream or canal, running under the stables, and out into the fields on the other side of the road; in this water are many Carps, which lie rolling about in sight, being fed by travellers, who amuse themselves by tossing them bread; but as soon as the weather grows at all severe, these fishes are no longer seen, because they retire under the stables, where they remain till the return of spring.”* They are so tenacious of life, that it is said they may be kept a long time out of water, by being hung surrounded by wet moss in a net in a cool place, feeding them with sopped bread, and occasionally throwing cold water over them.† Mr. Yarrell attributes to them a considerable degree of intelligence. “Carp manage to avoid a net, burying themselves in the mud, and allowing a heavily-loaded ground line to pass over them without their moving; but if disturbed from their hiding-places, frequently endeavouring, like the Grey Mullet, to escape over the corked head-line.”‡ Their usual length is from twelve to eighteen inches, but some are said to attain the length of three feet, and the

* Nat. Hist. Selb. p. 144, Jenyns’ Edition.

† Walton, 1815, p. 255 (note).

‡ Br. Fishes, Vol. i. p. 309.

weight of twenty pounds. It is, however, a difficult fish to capture,—the angler for Carp, according to the quaint but amiable father of anglers, having need to “put on a very large measure of patience.” Walton’s editor, after quoting Gesner’s statement, that a Carp has been known to live in the Palatine above a hundred years,—adds in a note, “that in 1782, in the basin at Emanuel College, Cambridge, a Carp was then living, that had been in the water thirty-six years; which, though it had lost one eye, knew, and would constantly approach its feeder.”*

To this genus belongs that radiant little pet of the drawing-room, the Gold-fish, (*C. Auratus*), the only fish commonly kept in a state of domestication. It is a native of some mountain lakes in China, in which country it has been for many ages domesticated, as with us, and kept in porcelain vessels for the amusement of the ladies. Thence it appears they were brought to Portugal, where they have now become quite naturalized, abounding in many of its streams. Into our own country, they seem to have been first introduced about the beginning of the seventeenth century; but although they multiply freely in ponds and tanks, we are not aware that they have as yet in any instance attained an independence of man’s protection in this country. The great variety of colour assumed by these beautiful little fishes, including every possible shade and combination of silver, gold, brilliant orange and purple, does not indicate any distinction of species, any

* Edit. 1815. p. 350

more than the great difference sometimes observed in the number and size of the fins, these variations being merely the result of domestication. They are, however, always beautiful, and kept as they are in clear glass globes, where

“The Goldfish gleams through the crystal vase,”

occasionally dilating to gigantic proportions by the refraction of the water, they form an interesting and pleasing object, “not to mention that the introduction of another element and its inhabitants into our parlours engages the fancy in a very agreeable manner.” “They even recommend themselves,” says Mr. Jesse, “by another agreeable quality, that of appearing to entertain an affection for each other. A person who kept two together in a glass, gave one of them away; the other refused to eat, and showed evident symptoms of unhappiness, till his companion was restored to him.”* A correspondent in the Penny Magazine† gives some particulars of their habits, which we abridge:—“They breed in ponds and small portions of water, but are not to be found in any of our rivers. A flow of water, even through a pond, is almost sure of destroying them, the water by such a change proving too cold for them; but in stagnant water, and even in fetid ditches, they appear to do well. Their spawning time in England varies according to the season, from May to July. The approach of this season, is known by their following each other with very

* Gleanings in Nat. History.

+ 1835, p. 59.

quickened motion, sometimes jumping out of the water, or thrusting themselves into weeds so near the bank as to be taken by the hand. The males are not distinguishable from the females by a difference of colour, but by the dorsal fin, which is short and ends abruptly; but in the female it is long, extending almost to the tail, and of a fan-like shape. The actual time of spawning may be perceived by an unusual stillness in the fish, and by their keeping in deep water, even in the hottest weather, contrary to their usual practice of basking in the sun at the very surface, with their backs frequently out of water. When the spawn becomes alive, the fish are of a very dark colour, some nearly black, others of a dark slate colour; the former produces the red or gold fish, the latter, the white or silver fish. Although these fish are extremely tender, yet they are seldom affected by our coldest winters. The heat, however, of the hand is sufficient to deprive them of life, and is probably one reason why they seldom live long when confined in glasses. Persons desirous of keeping them, should change their water very frequently, and remove the fish by a small landing net. It is also well to keep them during the night in a tub of water, and remove them into the glass in the morning. The best time to take them from the pond is in April, or before they become heavy with spawn, for, in confinement, they rarely survive the spawning season. They never spawn in a transparent vessel."

The Barbel, (*Barbus* Vulgaris*,) noted for the worm-like tentacles about its mouth, and for having the dorsal and anal short, is closely allied to the Carp. It attains a considerable size, one being mentioned which weighed fifteen and a half pounds. According to Walton, however, and other writers, the flesh, and especially the spawn, is unwholesome. The male and female cover up the spawn with gravel, after it is deposited by the latter. Mr. Jesse says of fishes of different species which were kept in confinement, "the Barbel were the shyest, and seemed most impatient of observation; although in the spring, when they could not perceive any one watching them, they would roll about, and rub themselves against the brick-work, and show considerable playfulness." And old Izaak says, that he is "a lusty and cunning fish; so lusty and cunning, as to endanger the breaking of the angler's line, by running his head forcibly towards any covert, or hole, or bank, and then striking at the line to break it off with his tail; and also so cunning, to nibble and suck off your worm close to the hook, and yet avoid the letting the hook come into his mouth."† In the same edition of this work, from which the preceding is taken, is a highly characteristic anecdote of angling, given by the editor, in a note apparently quoted from Hawkins. "A lover of angling told me the following story: He was fishing in the river Lea, at the ferry called Jeremy's,

* Barba, a beard.

† P. 288 (1815).

and had hooked a large fish at the time when some Londoners with their horses were passing; they congratulated him on his success, and got out of the ferry boat, but, finding the fish not likely to yield, mounted their horses and rode off. The fact was, that, angling for small fish, his bait had been taken by a Barbel, too big for the fisher to manage. Not caring to risk his tackle by attempting to raise him, he hoped to tire him, and to that end, suffered himself to be led (to use his own expression) as a blind man is by his dog, several yards up, and as many down the bank of the river, in short, for so many hours, that the horsemen above-mentioned, (who had been at Walthamstow, and dined,) were returned; who seeing him thus occupied, cried out, ‘What, master, another large fish?’ ‘No,’ says Piscator, ‘it is the very same.’ ‘Nay,’ says one of them, ‘that can never be; for it is five hours since we crossed the river.’ And not believing him, they rode on their way. At length our angler determined to do that which a less patient one would have done long before; he made one vigorous effort to land his fish, broke his tackle and lost him!**

Slightly differing, except in unimportant particulars, from the Carps, are our well-known river fish, the Gudgeon, (*Gobio Fluvialis*), the Bream, (*Abramis Brama*), and the Tench, (*Tinca Vulgaris*), concerning the last of which the following interesting notice is given in Daniell’s *Rural Sports*:—

* P. 290.

“A piece of water which had been ordered to be filled up, and into which wood and rubbish had been thrown for years, was directed to be cleared out. Persons were accordingly employed ; and, almost choked up by weeds and mud, so little water remained, that no person expected to see any fish except a few Eels ; yet nearly two hundred brace of Tench of all sizes, and as many Perch, were found. After the pond was thought to be quite free, under some roots there seemed to be an animal which was conjectured to be an Otter ; the place was surrounded, and on opening an entrance among the roots, a Tench was found, of most singular form, having literally assumed the shape of the hole, in which he had of course many years been confined. His length from eye to fork, was thirty-three inches ; his circumference, almost to the tail, was twenty seven inches ; his weight eleven pounds nine ounces and a quarter ; the colour also was singular, his belly being that of a Char, or vermillion. This extraordinary fish, after having been inspected by many gentlemen, was carefully put into a pond, and at the time the account was written, twelve months afterwards, was alive and well.”

Leuciscus, the Dace, the Roach, &c.*

This, in fact, like those fishes we have just noticed, is but a subgenus of the Carp tribe, distinguished by the dorsal and anal being both short, and

* Λευκός, leukos, white.

without any strong rays; they have no tentacles at the mouth. Of this division, no less than ten species are natives of British waters, a greater number than of any other genus. Among them, the best known are the Dace, (*L. Vulgaris*), the Roach, (*L. Rutilus*), remarkable for the silvery whiteness of the sides and belly, and the bright scarlet hue of the fins; the logger-headed Chub, as Walton calls him, (*L. Cephalus*), and the prettily mottled Minnow, (*L. Phoxinus*), proverbial for its minuteness. Pretty as is the last-named species with its bright eye, marbled sides, and pink belly, it is accused of the habit of cannibalism, too common we fear among fishes. The poet Cowper in one of his letters says, “Mrs. Unwin and I, in crossing a brook, saw from the footbridge, something at the bottom of the water which had the appearance of a flower. Observing it attentively, I found that it consisted of a circular assemblage of Minnows; their heads all met in the centre, and their tails diverging at equal distances, and being elevated above their heads, gave them the appearance of a flower half blown. One was longer than the rest; and as often as a straggler came in sight, he quitted his place to pursue him; and having driven him away, he returned to it again; no other Minnow offering to take it in his absence. This I saw him do several times. The object that had attracted them all was a dead Minnow, which they seemed to be devouring.” From the scales of several species of this genus, and especially from those of the Bleak, (*L. Alburnus*), is obtained a

silvery substance, which is used to colour the interior of glass beads, in imitation of pearls.

FAM. II.—ESOCIDÆ.

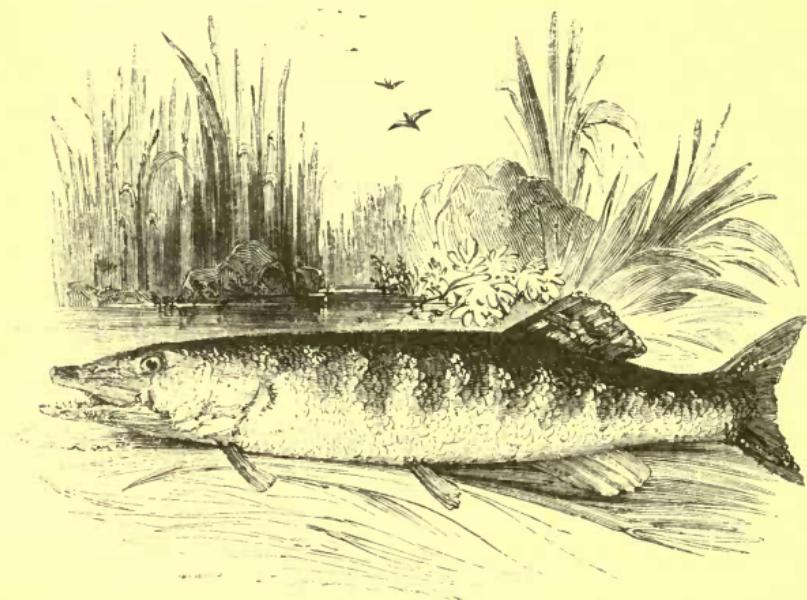
The members of this family are known by their flattened head and wide mouth, the upper jaw bones destitute of teeth, and concealed in the thickness of the lips; numerous sharp teeth in other parts of the mouth; the body is of a lengthened form, with the dorsal fin far back, over the anal. They ascend rivers, and are remarkable for their voracity and quick digestion.

Esox, the Pike.*

The head is large, flat, oblong and blunt; the jaws, palate, throat, and even the gill-rays bristled with sharp teeth of various sizes; those of the lower jaw long and pointed: a large air-bladder. They are found in the rivers and lakes of both continents; and some very large American species are encased in strong bony square scales, as if in armour. The common Pike, or Jack (*Esox Lucius*) is now pretty abundant in many of our rivers, but was introduced from the continent, probably not much before the time of Edward I. From its fierceness and voracity, it has been called the tyrant of the rivers, and some curious instances are on record, of

* The Latin name for the Salmon in *Pliny*, ix. 15.

its indiscriminate rapacity. Bowlker says, “My father catched a Pike, in Barn Mere, [in Cheshire,] was an ell long, and weighed thirty-five pounds,



THE PIKE (*Esox Lucius*).

which he brought to the Lord Cholmondeley; his Lordship ordered it to be turned into a canal in the garden, wherein were abundance of several sorts of fish. About twelve months after, his lordship draw'd the canal, and found that this overgrown Pike had devoured all the fish, except one large Carp that weighed nine or ten pounds, and that was bitten in several places. The Pike was then put into the canal again, together with abundance of fish with him to feed upon, all which he devoured in less than a year's time; and was observed by the gardener

and workmen there, to take the ducks and other water-fowl, under water. Whereupon, they shot magpies and crows, and threw them into the canal, which the Pike took before their eyes; of this they acquainted their Lord; who thereupon ordered the slaughtermen to fling in calves' bellies, chickens' offal, and such like garbage to him, to prey upon; but being soon after neglected, he died, as supposed, for want of food.* In one of the London papers for the 2nd, and 25th of January, 1765, the following notices occur:—“About ten days ago, a large Pike was caught in the river Ouse, which weighed upwards of twenty-eight pounds, and was sold to a gentleman in the neighbourhood for a guinea. As the cookmaid was gutting the fish, she found, to her great astonishment, a watch with a black ribbon, and two steel seals annexed, in the body of the Pike; the gentleman's butler, upon opening the watch, found the maker's name, by which it appears to have belonged to a gentleman's servant, who was unfortunately drowned about six weeks ago, between Littleport and South ferry.” Again, “On Tuesday last, at Lillishall lime-works, near Newport, a pool about nine yards deep, which had not been fished for ages, was let off in draining the works, when an enormous Pike was found; he was drawn out by a rope, fastened round his head and gills, amidst hundreds of spectators, in which service a great many men were employed; he weighed upwards of 170 pounds, and is thought to be the largest ever seen. Some time ago,

* Art of Angling, p. 9.

the clerk of the parish was trolling in the above pool, when his bait was seized by this furious creature, which by a sudden jerk, pulled him in, and doubtless would have devoured him also, had he not by wonderful agility and dexterous swimming, escaped the dreadful jaws of this voracious animal."

The following given by Fuller, connected with a well-known jest, is too good to be omitted: "A cub fox drinking out of the river Arnus in Italy, had his head seized on by a mighty Pike, so that neither could free themselves, but were ingrappled together. In this contest, a young man runs into the water, takes them out both alive, and carrieth them to the Duke of Florence, whose palace was hard by. The porter would not admit him, without promise of sharing his full half of what the duke should give him; to which he (hopeless otherwise of entrance) consented. The duke, highly affected with the rarity, was about giving him a good reward, which the other refused, desiring his highness would appoint one of his guard to give him an hundred lashes, that so his porter might have fifty, according to his composition. And here my intelligence leaveth me how much farther the jest was followed."* Several instances have also been known of Pikes snapping at the feet or hands of men bathing. The Pike attains a great age:—Pennant mentions one ninety years old: and Gesner speaks of one taken out of a lake in Suabia, in 1497, to which was attached a

* Fuller's Worthies, Lincolnsh. p. 144.

ring, bearing date 1230, two hundred and sixty seven years before: it weighed three hundred and fifty pounds.*

The flesh of the Pike is in very high estimation; and old Izaak Walton, who seems to have been as great a connoisseur in cooking as in angling, gives a long direction for roasting him, "*when caught*," which he says is "choicely good;" making "a dish of meat too good for any but anglers, or very honest men." We shall not, however, as it is said to be somewhat of "a secret," enlighten our readers with it; but, instead, we shall give a still more important direction, "How to catch the Pyke."

"Take a codlynge hoke; and take a Roche, or a fresshe Heeryng; and a wyre wyth an hole in the ende, and put it in at the mouthe, and out at the taylle, downe by the rydge of the fresshe Heeryng; and thenne put the lyne of your hoke in after, and drawe the hoke into the cheke of the fresshe Heeryng;—then put a plumbe of lede upon your lyne, a yerde longe from your hoke, and a flote in midway betwene; and caste it in a pytte where the Pyke usyth; and this is the beste and moost surest crafte of takynge the Pyke. Another mannere takynge of hym there is; take a frosshe, [frog,] and put it on your hoke, at the necke, betwene the skynne and the body, on the backe-half, and put on a flote a yerde therefro, and cast it where the Pyke hauntyth, and ye shall haue hym. Another mannere:—Take the same bayte, and put it in asafetida, and caste it in the

* De Piscibus, Introd.

water wyth a corde and a corke, and ye shall not fayle of hym. And yf ye lyst to have a gode sporte, thenne tye the corde to a gose fote; and ye shall see gode halyng, whether the Gose or the Pyke shall haue the better.”*

Belone,† the Garfish.

A marine fish, placed by Linnæus with the true Pikes, but distinguished by the prolongation of the mouth into a sharp and slender beak, armed with many small teeth; the body also long and slender, covered with minute scales. The bones of this genus, are remarkable for being of a vivid green colour; not dependent on cooking, as is commonly believed. The common Garfish, Gorefish, Sea-Pike, or Mackarel Guide (*B. Vulgaris*), is common on our coast in spring, but remains only a short time. It swims usually near the surface, frequently leaping out of water. Its food is unknown. It is about two feet long; the back of a dark bluish green, the belly silvery white. It is eaten, but is not much esteemed.

Exocætus,‡ the Flying-fish.

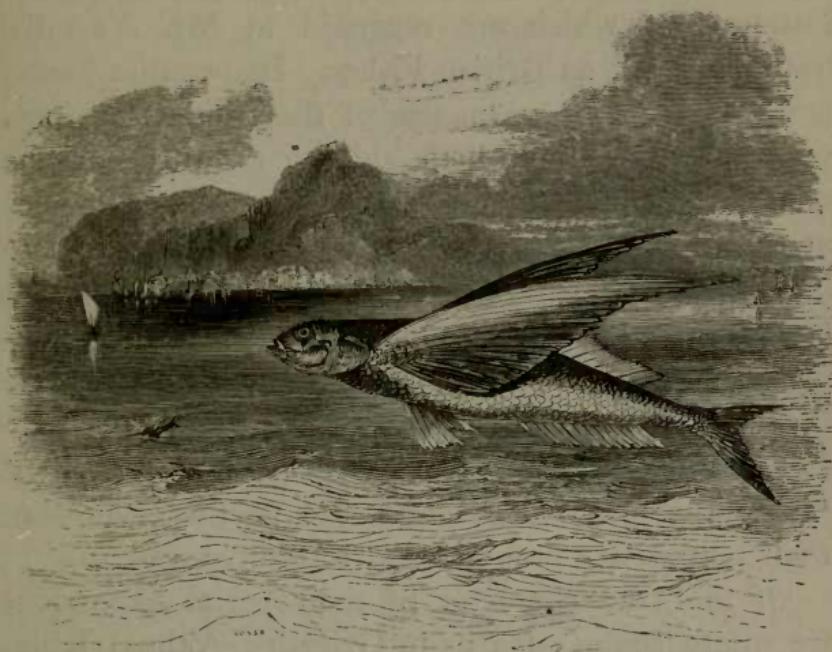
As in the Pikes, the dorsal is situated above the anal: the head and body are clothed with rather large scales; the head is flattened above, and on the

* The Treatyse of Fyshynge, by Dame Juliana Berners, 1486.

† Βέλων, *belone*, the Greek name of this fish.

‡ ἔξω, *exo*, out, and κοιτάω, *koitao*, to sleep, the Greek name of a fish supposed to sleep out of water.

sides; jaws furnished with small pointed teeth; lower part of the tail fin larger than the upper; pectorals very large, nearly as long as the body, by the action of which, they can support themselves in the air for a few moments.



FLYING-FISH (*Exocetus Volitans*).

As the Bat among the Mammalia seems to usurp the powers and functions of Birds, so does the small tribe now before us; their flight, however (so called), is more like the long leaps of the Flying Squirrel and Phalanger, than the continued aerial motion of a Bird, or even of a Bat, being nothing more than a violent projection into the air, by an impetus already acquired in the water, no new impulse being gained,

and no new power of changing the direction being possessed ; so that the fish falls into the water again, not because the wing-like fins have become dry, but because the force of the original leap is exhausted.

The common Atlantic Flying-fish, (*E. Volitans*,) has occasionally strayed to our own shores, several instances of which are recorded in Mr. Yarrell's beautiful work on British Fishes. Its peculiar home, however, is in the warm seas of the tropical regions, where shoals of these little shining creatures may be seen daily, harassed and pursued in their own element, and quitting it for a few seconds to expose themselves to equal dangers from above. Their lot has been depicted as unusually hard, for while Dolphins, Bonettos, and other rapacious fishes pursue them unrelentingly below, the Albatross and Frigate Pelican wait in the air to catch them the instant they emerge. Still, it must not be forgotten, that their powers are proportioned to their perils.

Of the true character of their aerial excursions we quote some remarks in Griffith's Animal Kingdom. They "rise into the air by thousands at once, and in all possible directions. Their flight, as it is called, carries them fifteen or eighteen feet out of the water ; but it is an error to call them *Flying* fishes ; they do not in reality fly—they only leap into the air, where they have not the power of sustaining themselves at will. They never come forth from the water, except after a rapid course of swimming. When put alive into a vessel of sea water, in which there was not sufficient space to acquire mo-

mentum, they were only able to rise out of it a few inches. The lines which they traverse when they enjoy full liberty of motion, are very low curves, and always in the direction of their previous progress in the water.”*

Mr. G. Bennett paid much attention to these fishes in his late voyage to the South Sea. “ I have never,” he observes, “ been able to see any percussion of the pectoral fins during flight: and the greatest length of time that I have seen these *volatile* fish on the *fin* has been thirty seconds by the watch, and their longest flight, mentioned by Captain Hall, has been two hundred yards, but he thinks that subsequent observation has extended the space. The most usual height of flight, as seen above the surface of the water, is from two to three feet; but I have known them come on board at a height of fourteen feet and upwards: and they have been well ascertained to come into the channels of a line-of-battle ship, which is considered as high as twenty feet and upwards.

“ But it must not be supposed they have the power of elevating themselves in the air, after having left their native element: for, on watching them, I have often seen them fall much below the elevation at which they first rose from the water, but never in any one instance could I observe them raise themselves from the height at which they first sprang; for I regard the elevation they take to depend on the power of the first spring or leap they make on

* Vol. x. p. 466.

leaving their native element.”* In our own personal observations of these fishes, however, we cannot help thinking, that we have now and then seen them alter their course slightly, rising and sinking again to avoid a wave. Usually, however, they shoot along in nearly a straight line, skimming so little above the surface, that we have often seen them strike the side of a rising wave and go under. They have much the appearance of white swallows, at a distance, but, when near, they gleam like polished silver, and their long fins resemble a transparent film, invisible unless pretty close. They fly by night as well as by day, being often found on a vessel’s deck in the morning. The flesh is not disagreeable, but dry and somewhat insipid.

FAM. III.—SILURIDÆ.

A group of fishes of remarkable, but repulsive, form, distinguished by the rounded cat-like shape of the head, the body destitute of true scales, and the mouth furnished with fleshy beards or tentacles.

Silurus.†

Besides the characters of the family given above, the true Silures have the first ray of the pectorals forming a strong and notched spine; a formidable

* Wand. in N. S. Wales, &c.

† The Greek name of some Egyptian fish of this family.

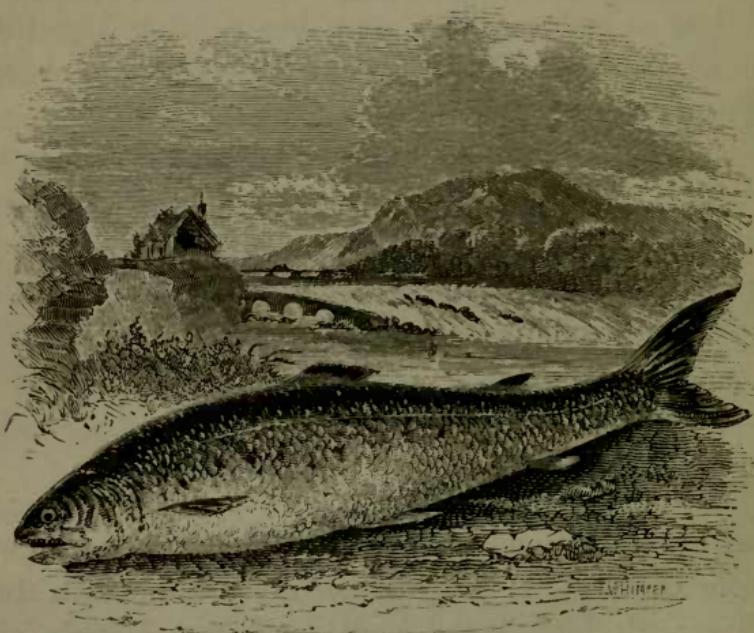
weapon, for it is so jointed with the bones of the shoulder, that, at will, the fish can either project it stiffly at right angles, or bring it down to the side. Wounds with this spine are the more dreaded, because they are frequently followed by lock-jaw. The Sly Silure (*S. Glanis*) is the largest fresh-water Fish found in Europe, sometimes weighing three hundred pounds. It hides itself in the mud, displaying its tentacles as a bait for other fishes, of whose approach it is probably made aware, by a delicate sense of touch residing in these appendages. Its flesh is soft and luscious, but neither digestible nor wholesome. The skin is naked, but covered with a mucous slime. To this genus belong several species in the American rivers, familiarly known by the name of Cat-fish. Other species have the place of true scales supplied by large bony plates, enveloping the sides; and some of these have the power of crawling out of the water.

FAM. IV.—SALMONIDÆ.

This very important family, whose flesh is so extensively used, and so highly valued as a delicate article of food, is distinguished by a smooth but well scaled, lengthened body, and two dorsals, the first with soft rays, the other called the *adipose*, small, formed of skin filled with fat, without rays. They generally ascend rivers to spawn, to accomplish which migration, they often overcome obstacles with astonishing strength, ingenuity, and perseverance.

Salmo, the Salmon, Trout, &c.

This genus is of all fishes the most amply furnished with teeth; having them in all parts of the jaws, tongue, palate, vomer, and throat. The ventrals are usually opposite the first dorsal, and the anal opposite the adipose. The gill-rays are usually from ten to twelve, but are not constant even in the same individual. The body is usually more or less spotted, and the flesh delicious.



THE SALMON (*Salmo Salar*).

The well-known Salmon, (*S. Salar*), the largest of the genus, forms the object of one of the most important of our national fisheries, of which an idea may be formed from the quantity sent to the London

market alone, during six days, (not selected as being unusually productive,) viz. 253 boxes.

Sooner or later in the spring, according to the season and the locality, the Salmon, which have spent some months in the ocean, begin to throng the mouths of the rivers. They remain a few days in the mingled salt and fresh water, before they proceed, when having become seasoned, they ascend the streams.

As the summer advances, they proceed higher and higher, and become more swollen with roe, and consequently out of season. We have mentioned the perseverance with which they surmount obstacles, in their progress to the spawning place: "they shoot up rapids with the velocity of arrows, and make wonderful efforts to surmount cascades and other impediments by leaping, frequently clearing an elevation of eight or ten feet, and, gaining the water above, pursue their course. If they fail in their attempt and fall back into the stream, it is only to remain a short time quiescent, and thus recruit their strength to enable them to make new efforts."* Mr. Mudie has described some of these feats which he has witnessed at the Fall of Kilmorac, in Inverness-shire. "The pool below this fall is very large; and, as it is the head of the run in one of the finest Salmon rivers in the North, and only a few miles distant from the sea, it is literally thronged with Salmon, which are continually attempting to pass the fall, but, without success, as the limit of their perpendicular

* Yarrell, Br. Fish, vol. ii. p. 8.

spring does not appear to exceed twelve or fourteen feet; at least, if they leap higher than that, they are aimless and exhausted, and the force of the current dashes them down again before they have recovered their energy. They often kill themselves by the violence of their exertions to ascend; and sometimes they fall upon the rocks, and are captured. It is, indeed, said, that one of the wonders which the Frasers of Lovat, who are lords of the manor, used to shew their guests, was a voluntarily cooked Salmon, at the Falls of Kilmorac. For this purpose, a kettle was placed upon the flat rock on the south side of the fall, close by the edge of the water, and kept full and boiling. There is a considerable extent of the rock where tents were erected, and the whole was under a canopy of overshadowing trees. There the company are said to have waited until a Salmon fell into the kettle, and was boiled in their presence.”*

The shallow beds of gravel near the sources of the streams having been at length reached, the Salmon proceeds to deposit its spawn, which is done in the end of summer or autumn. The male and female unite their efforts to make a trench, by working in the loose gravel with their noses, always against the stream; into this furrow, when completed, the female deposits her spawn, which is afterwards covered up again. The fish are now unfit for food, and are called unclean. At the end of winter, they gradually descend the rivers, and soon regain the

* Brit. Naturalist, vol. i. p. 191.

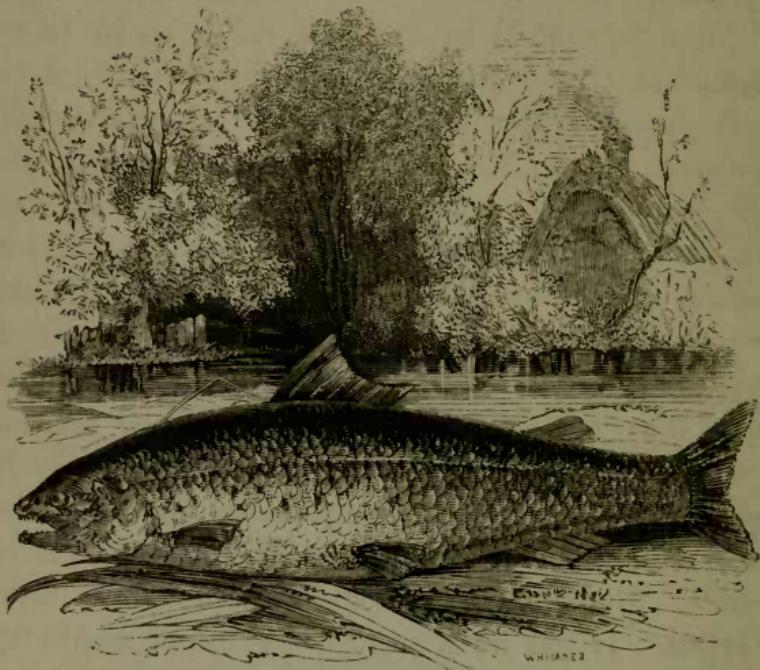
sea, where they recover their health and strength, and increase greatly in size, returning again in the summer to the rivers as before, very often (not *always*) ascending the identical stream which they left.

In the spring, the spawn deposited in the preceding autumn, is hatched, and the fry, less than an inch in length, ascend through the gravel, and proceed to pursue the same course as the adults, down to the sea, increasing in size as they go. In May or June, they usually reach the salt-water, in which they remain till the waning of the summer warms them again to seek the shallows. Their increase is very great and remarkably rapid, so that a fish of the first summer, will often weigh six pounds. Before the first spawning, the fish is called a Grilse. It has been proved by experiment, that fry confined in fresh-water, will grow and thrive, without any communication with the sea.* The Salmon has been known to attain the weight of eighty-three pounds.

The Salmon-Trout, (*S. Trutta*), in its habits and economy, much resembles the Salmon; migrating from the sea to the rivers, and back again. It is considered as next to that fine species in value for the excellence of its flesh. It is found in some parts of our country, but principally in the streams of Scotland, Wales, and Ireland. The largest individual on record weighed seventeen pounds.

The Common Trout, (*S. Fario*), which by its voracity, and no less by its cautious vigilance, affords ex-

* Yarrell's Br. Fishes, ii. 21.



THE TROUT (*Salmo Fario*).

cellent sport to the angler, is one of the most beautiful of the genus. The form is elegant, the curves which form the outline of the back and the belly being very graceful and flowing: the colour of the upper parts is yellowish, with many reddish spots, brighter on the sides, where the hue becomes golden yellow; the belly silvery white. And its excellence answers to its beauty; for, as Walton observes, “he may justly contend with all fresh-water fish, as the Mullet may with all sea-fish, for precedencey and daintiness of taste; and, being in right season, the most dainty palates have allowed precedencey to him.” The Trout does not descend

to the sea, but is a constant inhabitant of the rivers, haunting such places as afford deep holes and hollow banks, in which it lies concealed during the day, but in the night swims near the surface, snaps at flies, and hunts after small fishes, frogs, and even water-rats. “Though vigilant and cautious in the extreme, the Trout is also bold and active. A Pike and a Trout put into a confined place together, had several battles for a particular spot, but the Trout was eventually the master.”* Trout of fifteen pounds are occasionally caught in the Thames; but one is recorded to have been caught near Great Driffield in 1832, which was thirty one inches in length, twenty-one in girth, and weighed seventeen pounds. And, in 1822, one was taken near Salisbury, which weighed twenty-five pounds.

The fish called Charr, inhabiting mountain lakes, and marked by the brilliant orange hue of the underparts,—is a species of Salmon (*S. Alpinus*, *S. Salvelinus*, &c.). It is highly esteemed for its flavour, but does not afford much sport to the angler.

The Graylings (*Thymallus*†) resemble the Trouts, but are distinguished by the smallness of the mouth, the large size of the scales, and the great height and length of the first dorsal fin: the gills have seven or eight rays. They are generally handsome fishes, and scarcely inferior to the Trouts in flavour. When newly taken from the water, they emit a peculiar odour, resembling that of thyme. They do not appear to be migratory.

* Yarrell.

+ Θύμος, *thymos*, thyme.

We must also notice here, a beautiful, but little known fish, the Capelin, (*Mallotus** *Grœnlandicus*), closely allied to the Salmon genus; but marked by having small teeth resembling the pile of velvet, on the jaws, palate, and tongue: the body clothed with small scales; the dorsals and ventrals both behind the middle; the pectorals large and round, and almost meeting beneath. During the spawning season, the flank of the male is furnished with a projecting row of long narrow raised scales, resembling hairs. This little fish is important, as furnishing, during the season, a large proportion of the bait used in the Cod-fisheries of Newfoundland and Labrador. About the end of June, the Capelin come in shoals into the harbours of Newfoundland, pressing up to the shingles and sand beaches, in order to deposit their spawn. At these times, we have seen the water for many yards from the shore, literally alive with them, so that a bucket dipped in at random, is sure to be withdrawn half filled with the fish; while the beach itself is covered with the skipping bodies of those left by the retiring wave. The land is likewise a scene of animation; hundreds of the inhabitants throng to the shore, men, women, and children, and even rush into the water to the waist, armed with various implements of capture, from the little pail to the broad casting net. Immense numbers of the fish are thus taken, some of which are dried in the sun for winter use, and exportation; more are used while quite fresh, as bait for

* Μαλλωτός, *mallotos*, hairy.

the Cod, but by far the greatest portion is used as manure. The object of this periodical approach to the land, is the deposition of the spawn. If closely observed, every female is seen to be escorted by two males, one on each side, which press close to her, and thus the three rush up upon the beach. It is universally asserted by the fishermen, that the spawn is squeezed from the female by the mechanical pressure of the two males; but we doubt if anything more can be safely asserted, than that the males attach themselves thus closely to impregnate the roe as soon as it is excluded. The Capelin, though small, is a very beautiful fish: contrary to what usually prevails, the male is the larger, but he rarely exceeds seven inches in length; the general colour is a silvery white, with opaline reflections, and the back of the male is olive, studded, *when alive*, with numberless sparkling points of golden green, as if dusted with precious stones. The shoals are voraciously pursued to the beaches, not only by the Cod, and other fishes, but by various species of *Cetacea*.

FAM. V.—CLUPEADÆ.

The members of this family resemble those of the preceding in many important particulars, but are at once distinguished from them by wanting the adipose fin. They are chiefly marine fishes, but a few of the species ascend rivers.

Clupea, the Herrings.*

The whole form is flattened sidewise, and the belly even comes to a well-defined edge, which is notched by the scales, like the teeth of a saw; the scales are large, and very slightly attached; the teeth minute or sometimes wanting; the gills are so much divided, that all the species die almost instantly on being taken from the water; they have, of all fishes, the most slender and most numerous bones. Most of them are valuable as the objects of important periodical fisheries, and the most important of all, is doubtless, the common Herring (*C. Harengus*). This fish, as well as the Mackarel, was formerly supposed to migrate from clime to clime in immense armies, but there seems now to be no doubt, that the Herring inhabits the deep water around our coast throughout the year, though it is only in the autumn that they manifest their presence in such numbers, when they come into the shallow water to spawn. "And here," says Mr. Couch, "we cannot but admire the economy of Divine Providence, by which this and several other species of fish are brought to the shores, within the reach of man, at the time when they are in their highest perfection, and best fitted to be his food."†

The Dutch have long been celebrated for the excellence of their cured Herrings, and much of the

* *Clypeus*, a shield.

† Yarrell's Br. Fishes, ii. 114.

prosperity of that industrious nation has been attributed to its fisheries. Their value in our own country has been so highly estimated, as to give rise to many legal provisions for their promotion and government; and large, and we might say, even enormous bounties, have been by an ill-judged policy paid to those engaged in them. These have now however ceased, and the legitimate demand is allowed to regulate the supply. Still, so large is the quantity taken, that, in the year 1818-9, 340,660 barrels were cured in Great Britain, and in 1829-30, 329,557 barrels, of which more than half was exported. By far the greater portion of this vast quantity was taken on the northern coast of Scotland.

The Pilchard (*C. Pilchardus*) is very rarely seen to the eastward of Start Point in Devonshire; but Mr. Yarrell records, that, in August 1834, a shoal of Pilchards was observed in Poole Harbour, and so many fish were taken, that they were sold in the market at a penny a dozen.

We cannot enter into any details of the Sprat (*C. Sprattus*), though an important article of food; nor of the little White-bait, (*C. Alba*,) notorious as a luxury worthy of an annual visit, even of her Majesty's ministers, to Blackwall, for the purpose of enjoying it; nor of the Shad, (*C. Alosa*,) which ascends rivers, and attains a length of more than three feet. We must also pass by many foreign genera of this family, noticing only, for a moment, the *Engraulis*—the Anchovy.

Engraulis, the Anchovy.*

The belly is smooth, and not even edged in this genus, the mouth is very wide, the upper jaw the longer; the gill-openings large, and gill-rays twelve or more. The Anchovy of the Mediterranean (*E. Encrasicholus* †) was as highly esteemed by the ancients as by ourselves, for the savoury sauce, or pickle, called Garum, which they made of it. It is not uncommonly found on the western coasts of Europe, but the Mediterranean is its principal residence, from whence are exported, in a preserved state, large quantities as a condiment, the head and intestines having been first removed. They are chiefly caught in the night, by torchlight. Four to five inches is their usual length.

* Its ancient Greek name.

† Its Greek name; because it was repute to have the gall in the head; “*καρπι χολὴν ἔχει.*”

ORDER III.—SUB-BRACHIAN* MALACOPTERYGII.

THIS group contains those soft-finned fishes, whose ventrals are situated beneath the pectorals, which represent the fore limbs of mammals and birds. The pelvis, also, is connected with the bones of the shoulder. It is not a very numerous order, but it comprises forms differing widely from each other.

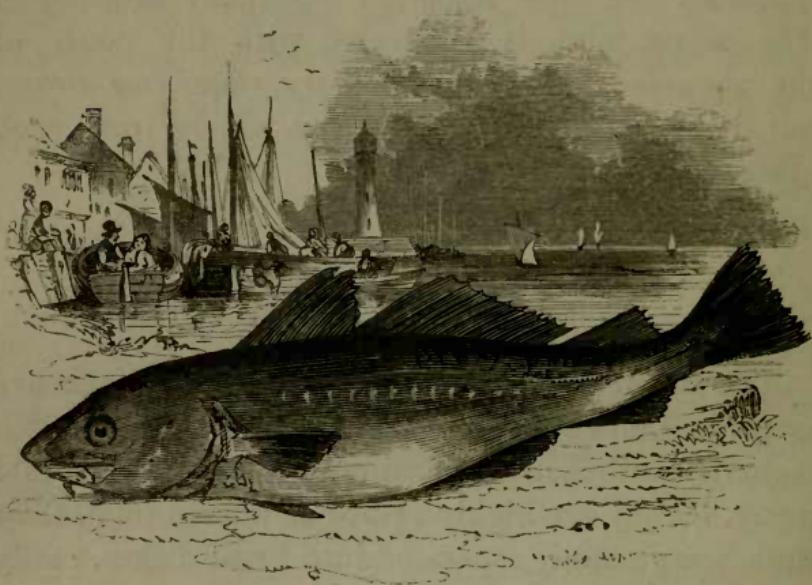
FAM. I.—GADIDÆ.

This family is composed of the single extensive genus of Linnæus named *Gadus*, the Cod, but which modern naturalists, following Cuvier, divide into many. They are highly valued as human food, their flesh being readily separated into broad flakes, easily salted and dried, and whether fresh or cured, being firm, white, wholesome, and agreeable: while, from the astonishing fertility and gregarious habits of some species, perhaps the most important fisheries in the world may be the pursuit of this tribe. Their distinctive marks are, the ventrals pointed and attached to the throat; the body longish, and covered

* *Sub*, under, and *brachium*, the arm.

with numerous soft scales, which are wanting on the head; small, sharp teeth in the jaws and vomer, arranged in rows, like the points of a rasp; gill-rays seven. Almost all have two or three dorsals, and one or two anals. They chiefly inhabit northern seas, and particularly the North Atlantic.

Morrhua, the Cod.*



THE COD (*Morrhua Vulgaris*).

The true Cods, including the Haddock, are distinguished by having three dorsal fins and two anals, and a fleshy beard hanging from the lower jaw. The common Cod (*M. Vulgaris*) is certainly to be placed

* A word of unknown derivation.

at the head of all fishes for commercial importance, its pursuit, cure, and transport, affording occupation to many thousands of families, and whole fleets of ships, and proving an invaluable nursery for expert and hardy seamen. Throughout the northern Atlantic it is most abundant, on the European as well as the American side, and in fecundity it probably exceeds every other species, the overwhelming number of *nine millions* of eggs having been found in the roe of a single female! A great number of Cod-fish are taken around our own coast, to supply the extensive home demand; but it is from the coast of Newfoundland and Labrador that the enormous quantities of dried Cod are chiefly drawn, which are transported so extensively to the Papal countries of southern Europe.

A few notes of the shore fishery of Newfoundland we can give from a personal observation of several years, which we do the more readily, because little is known of this fishery as it now exists, the published accounts being all out of date. The fish are caught almost exclusively in the bays and off the headlands of the island, the Bank fishery having been of late years almost wholly neglected, at least by the English. The shore catch commences about the end of May; boats, varying in size from that of a small skiff to twenty-five tons, proceed to the fishing-ground usually in the night, where each is moored with a grapnel, or small anchor. The hands at once proceed to bait and drop their hooks, which are sunk by a leaden weight.

The bait employed early in the season consists of shell-fish, or the flesh of true fishes, until the arrival of the Capelin shoals in June, which last two or three weeks, and are succeeded by the Launce and Squid, or Cuttle. Each man generally holds a line in each hand, and the moment he feels a bite the fish is drawn up, and the hook rebaited. When bait is scarce, as it often is before the Capelin season, an instrument called a *jigger* is used, consisting of two large hooks soldered together in the shanks by means of lead, which is made to assume the size and form of a Capelin; the points of the hooks are turned in opposite directions. This double hook is dropped without bait, and is continually moved up and down by jerks. The shining lead attracts many Cods, so that the *jigging* is almost sure to hook many of the fish in succession, and sometimes even two at once. Of course they are often sadly lacerated, and as the hooks frequently break out, the fish escapes in a wounded condition, and this is thought to have a tendency to drive the shoals from the ground. When the boat is loaded, or it is time to land the fish, they weigh and proceed to the *stage*, a long narrow wharf projecting from the shore, rudely walled and roofed. At the seaward end of this building is a long table, at which stand two men. The boat lying at the end of the stage, a man furnished with a *pew*, a curved iron spike at the end of a staff, throws up the fish one by one to the table above. The first man at the table, called the *header*, now seizes it, rips open

the belly with a double-edged knife, called a *cut-throat*, extracts the liver and entrails, and with a slight wrench of the left hand, assisted by the knife, cuts off the head ; all this is the operation of an instant. The liver is pushed down a square hole in the table, beneath which a cask is placed, and the head and offal fall through another hole into the sea. We may just pause to observe, that the liver, which is large, melts almost completely away into a very clear oil of rather agreeable odour, which is by no means the least valuable product of the fishery. A hundred quintals* of fish will generally yield two hogsheads of oil, averaging 22*l.* per tun. But to return : the header pushes along the fish to the second man, the *splitter*, who with another kind of knife cuts out the spine about as far as the vent, the lower part being left in. It is then thrown down on the floor of the stage, where, after having been washed, it is arranged with others in layers, —a layer of fish, opened, and laid back downwards, and a layer of salt, alternately. A hundred quintals of fish require ten hogsheads of salt. The pile of fish lies in this state for a few days, until the salt has penetrated the flesh ; they are then taken out in hand barrows on a sunny day, and spread singly either on the naked shingle-beach, or on *flakes* for the purpose, a sort of low but broad scaffolding erected, with poles laid across, and loosely covered with the flat boughs of the spruce or fir, so that the air reaches each side of the drying fish. For

* A quintal is 112 lbs.

many days they are thus exposed, but only in bright weather, and at night they are carefully laid in circular piles, the tails all pointing inwards, and so built as that the centre shall be higher than the edge. On the pile are laid "rinds," long pieces of the bark of the balsam fir (*Pinus Balsamea*) taken off in spring and flattened by pressure, which project over the edges of the pile, and are secured by heavy stones. When quite dry, and brought for sale to the merchant, the fish are examined by a *culler*, who stands before a board and passes every fish before him, distributing them into three qualities, the best called merchantable, the secondary, Madeira, and the very inferior, West India. The causes of inferiority in the last two sorts, named from the markets to which, *formerly*, they were respectively consigned, are various,—such as incipient decomposition before curing, too much salt in the process, exposure to rain or damp, accidental breakage, &c. They are then weighed by the quintal of 112lbs. The price, from 1827 to 1835, averaged for shore-fish as follows: Merchantable, 11s. to 13s. 6d.; Madeira, 9s. to 11s.; West India, 8s. to 10s. per quintal; but we have understood that it has been rather higher since we left the island. The first quality is chiefly sent, stowed in bulk, to the ports of Portugal, Spain, and Italy; and a vent for the inferior sorts, pressed in casks, is found in the markets of the West Indies and Brazil. A large number of the inhabitants of Newfoundland, however, prosecute the fishery on the coast of Labrador,

whither they proceed in June in schooners of fifty to one hundred and twenty tons : they scatter themselves in the numerous uninhabited harbours of that desolate shore, split and salt the fish on board, but dry it on the beach, and return with their cargo about October. The Labrador fish is much smaller and thinner, and obtains only an inferior price ; it is scarcely saleable at any other than Italian markets. Of late years, the Newfoundlanders have found formidable rivals in the French, Americans, and Norwegians, the last of whom dry their fish without salt. The annual produce of our Newfoundland fishery may be estimated at 600,000 quintals of fish, and 3000 tuns of oil.

We cannot enter into any details of the remaining genera of this serviceable family ; it will be sufficient to remark, that the Whiting, the Pollack, the Hake, the Ling, and other species closely allied to the Cod, are all valuable, though in different degrees.

FAM. II.—PLEURONECTIDÆ.*

We have now arrived at the most singular and unparalleled variation of structure to be found in the whole range of vertebrate animals. Hitherto, we have invariably found such a symmetry in form and external organs, that if any animal were divided by a straight line down the middle, one side would exactly correspond to the other ; but in the

* Πλευρα, *pleura*, the side, and νηκτης, *nektes*, a swimmer.

family before us, consisting of the Flat-fish, as they are familiarly called, this symmetry no longer exists. They swim not in an upright position, but upon one side, as if we should imagine a Salmon to swim in the position in which it lies on the fishmonger's table. Some species have the right side, and some the left uppermost; but it is always normally the same side in the same species. Now, as they are ground-fish, always keeping at the bottom, if the eyes were placed as usual, one would be useless, being immersed in the mud; they are therefore, strange to say, both placed on one side, one being immediately above the other, not always, however, exactly in a line, nor are they always equal in size. Again, the upper side monopolizes all the colour of the fish which is usually of a dark brown, the under side being white. It is easy to see the wisdom of this arrangement. The two sides of the mouth are not equal, nor are, generally, the pectoral fins. Yet, with all these irregularities, the skeleton is found to be constructed on the common plan, all the usual bones being present, however modified in figure and situation. We may add, to the peculiarities already mentioned, a few other distinctive characters; the whole form is extremely thin and flat sidewise, but broad and more or less lozenge-shaped in its outline; the dorsal runs along the whole back, and the anal along the belly, so that the latter with the ventrals almost exactly answers to the former: the gills have six rays.

Being destitute of the air-bladder, Flat-fishes are

confined in their movements to the neighbourhood of the bottom, where they generally swim but slowly; but if suddenly alarmed, they shoot rapidly along for a short distance in a vertical position, displaying the white surface if the observer happen to be on that side, but they immediately sink down flat and motionless as before. Most of the species are very good food, and some of them are scarcely paralleled in exquisite flavour and delicacy.

Platessa, the Plaice.*

In this genus the eyes are on the right side of the head: the dorsal begins over the upper eye, but neither it nor the anal quite reaches the tail-fin: each jaw has a row of teeth, and there are some in the throat. The common Plaice (*P. Vulgaris*) is well known in every fish-market, and is easily distinguished by the bright orange spots which diversify its dark-brown hue. Its flesh is esteemed, and it is caught in great numbers by the hook, the trawl-net, and the barbed spear. It has been known to attain the weight of fifteen pounds, but half that weight is considered great. The Flounder (*P. Flesus*) is much smaller than the Plaice, and is not so highly prized. It is more subject than any other Flat-fish to accidental variation, specimens being occasionally seen white on both sides, others coloured on both sides, while those which are “turned,” having the colour and eyes on the left

* Πλατύς, *platys*, broad.

instead of the right side, are quite common. Both these species will thrive if confined to fresh water; they feed on insects, worms, and small shell-fish.

Hippoglossus, the Halibut.*

The Halibut has stronger and sharper teeth than the Plaice, which it much resembles in its fins; the form is more oblong, and thicker in proportion to the width. In some of the species the eyes are on the left, and in others on the right. The latter is the case with the great Northern Halibut, (*H. Vulgaris*,) the largest of the family, attaining the dimensions of eight feet in length, and a weight of five hundred pounds. It is occasionally to be seen in the shops of the London fishmongers, where it is sure to attract notice from its gigantic size and unusual appearance. It is commonly sold in cuts at a low rate, being little esteemed.

Rhombus,† the Turbot.

The Turbots have the eyes and colour on the left side; the dorsal advances before the eyes, and, as well as the anal, reaches to the tail; teeth in the jaws and throat, small and densely crowded. Our shores produce five or six species, of which the well-known Turbot (*R. Maximus*) is the largest and most highly and deservedly esteemed. It usu-

* *Ιππός, hippos*, a horse, and *γλωσσα, glossa*, the tongue.

† From its shape.

ally weighs from five to ten pounds ; but one was taken near Whitby, in 1832, which weighed one hundred and ninety pounds, and measured six feet across.* It is caught with the hook as well as with the net, the former baited with small fishes. The greatest part of the fishery is in the hands of the Dutch, who are said to obtain 80,000*l.* a-year for the supply of the London market alone. Turbots are occasionally liable to the same variations as we have noticed in speaking of the Flounder.

Solea,† *the Sole.*

Like the Plaices and Halibuts, the Soles are right-sided fish ; the mouth on the under side is distorted, on which side of the jaws alone teeth are found ; the fins extend to the tail ; the snout projects a little beyond the mouth ; the general form is oblong oval. The common Sole (*S. Vulgaris*) is found all round our coast, but those of the Channel are preferred, being larger and of finer flavour. They are usually obtained by trawling, — rarely taking bait. Eighty thousand bushels of Soles have been sent to the London market in the course of one year. The Sole, as well as some other sea-fishes, appears to live and thrive in fresh water. It is taken in the river Arun in Sussex, where it evidently breeds ; and in a pond in Guernsey it becomes twice as thick as those residing in the sea.

* Yarrell.

† Its ancient Latin name.

FAM. III.—DISCOBOLIDÆ.*

This is a small group of fishes remarkable for having their large pectorals extending to the under surface of the body, where they take stronger rays, curve slightly forwards, and join each other by a membrane going across, so as to form a disk by which they adhere to other substances. In some, the ventrals unite to form a second disk or sucker, in contact with the former.

Cyclopterus,† the Sucker.

The pectorals and the ventrals form but a single disk, oval and concave. The skin is without scales, but covered with thick slime, and studded with hard tubercles arranged in lines; the whole form is deep, thick, and short; the first dorsal enclosed in a thick tubercled skin. The Lumpsucker (*C. Lumpus*) is taken around our shores, especially towards the north, and is eaten. It is remarkable for its odd and uncouth form, as well as for the variations of bright colours which adorn it: the back and sides being painted with deep blue, azure, and purple, while the under surface and fins are of a rich orange. It reaches a foot and a half in length,

* Δισκοβόλος, *diskobolos*, one who played with the disk in the ancient games.

† Κύκλος, *kyklos*, a circle, and πτερόν, *pterón*, a wing, or fin.

or more. Slow of motion, and incapable of defence, it often becomes the prey of the larger fishes, while itself preys on young fish, crustacea, &c. The male is said to keep watch over the spawn when deposited. It adheres by its disk so firmly, that Pennant lifted a tub containing several gallons of water, by grasping the tail of a Lumpfish, which had fixed itself to the bottom.

FAM. IV.—ECHENEIDÆ.

Echeneis, the Remora.*

This family contains but one singular genus, quite separate from any other family, and marked by an organ on the head of curious construction, whose use is involved in much obscurity. It consists of a long-oval concave disk running along the top of the head; a ridge runs length-wise through the centre, and a number of short ridges (about eighteen in the common Mediterranean species, *E. Remora*, and twenty-four in a species we have seen numerous in the Gulf of Mexico) run across each of these longitudinal divisions; these horny plates are finely toothed on the edge, and can either be made to lie flat, or be erected, not, however, perpendicularly, but inclined backward. The body is much lengthened, and the West Indian species, which has fallen under our own observation, very closely resembled in form, colour,

* *Exēnis, echeneis*, its ancient Greek name.

and manner of swimming, the young of the White Shark. Most of those were about two feet in length, very slender, and, when taken out of water, were covered with a viscid slime, which concealed a surface of small oblong bony scales, detected only by a roughness when the hand was passed against the grain. The mouth opened on the upper side, from the projection of the lower jaw. While at liberty, these fishes were close attendants on a large Shark, one or two on each side, generally just over his pectoral fins, keeping their position with respect to him, like the Pilotfish; sometimes they were seen belly upward, adhering by the sucker to the upper side of the Shark's fin; at other times they were detached, and numbers were around, without so closely accompanying him. We noticed some attach themselves to the rudder of the ship; one would swim up with his back turned towards it, and stick on in an instant, the vessel moving at about three knots; there it would remain off and on several hours, sometimes detaching itself, and adhering again instantly; for what end it would be difficult to say. When in captivity, we found that the sucker adhered to everything it touched, provided the surface would cover the organ, apparently without the volition of the animal, and so strongly, as to resist our endeavours to drag it off, without inserting something beneath the sucker. In Griffith's Cuvier, it is stated that the Echeneis is used to capture turtles. "In 1809, when Mr. H. Salt, was at Mozambique, having received a present of one of these fish, all

the inhabitants assured him that they were wont to employ it, by fastening it with a cord to a boat, and that it fixed itself by the head to the breast-plate of the first turtle it met, with so much force, that the latter could not escape. Commerson has likewise reported something of the same kind.”*

The ancients, however, were wont to attribute to these fishes the power even to arrest a ship in full sail; and the Romans consoled themselves for the loss of the battle of Actium, by imputing it to the delay of Antony’s ship by an Echeneïs:

“Puppim retinet in mediis echeneïs aquis.”—LUCAN.

* Anim. Kingd. vol. ix. p. 86.

ORDER IV.—APODAL* MALACOPTERYGII.+

THIS Order, including but a single family, comprises those soft-finned Fishes, whose body, greatly lengthened, assumes a serpent-form, and which are destitute of ventral fins. They have a thick, soft, skin, which almost conceals their scales ; and their bones are few.

Anguilla,† the Eel.

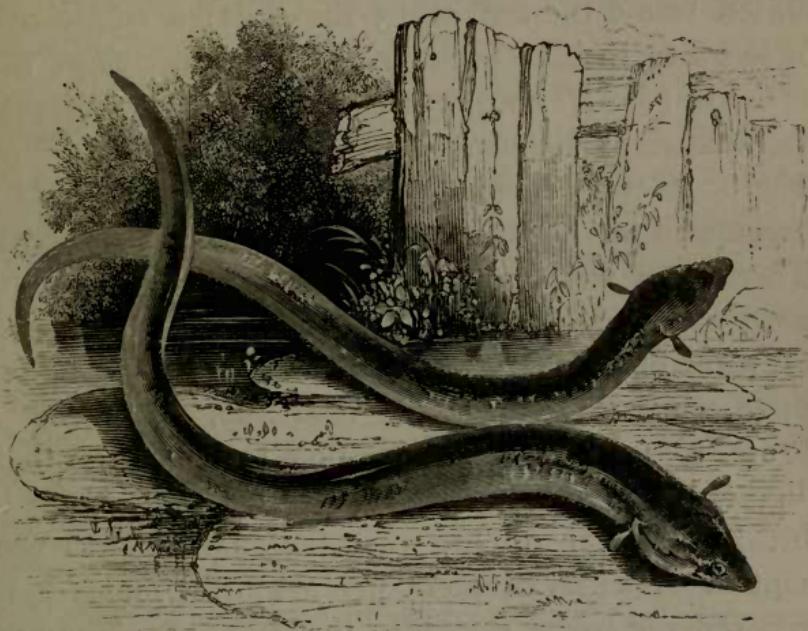
The gill-rays of the Eels are enveloped in the skin, and communicate with the water by an orifice at some distance back, from which circumstance these fishes can remain a long time out of water with impunity. The pectorals are immediately over the gill aperture ; the dorsal and anal are continued round the end of the tail. We have three fresh-water species, besides the Conger, (*A. Conger*,) which is a large marine Eel. The commonest of our Eels is the Sharp-nosed, (*A. Acutirostris*,) which is well-known in every locality, being highly esteemed as food. All the species migrate to the sea in the autumn, where they spend the winter, ascending the streams to spawn ; for it is now nearly ascertain-

* A, without, and πούς, *pous*, a foot (meaning the ventral fin).

+ See page 119.

† *Anguis* a snake.

ed, that the young of the Eel is produced by spawn, as of most other fishes. During the night, Eels frequently leave the water, and crawl through the grass; the writer recollects, that, when a boy, he found an Eel crawling in a meadow near Swanage,



COMMON EEL (*Anguilla Acutirostris*).

one evening at haymaking time, a considerable distance from any water. Mr. Yarrell mentions two Eels which weighed respectively twenty-seven, and twenty-three, pounds.

*Muræna.**

The historical interest which attaches to this singular fish, renders it necessary that it should be noticed. It has no trace of the pectoral fins, and the dorsal and anal are exceedingly narrow, but united round the tail, as in the Eels: a single row of sharp teeth is in each jaw. The Muræna of the ancients (*M. Helena*) was so highly esteemed, that the luxurious Romans kept it in large reservoirs, where it was carefully fattened, and frequently became so tame, as to come at the call of its feeder. There is a well-known story narrated by Pliny, of a wretch named Vediūs Pollio, who was in the habit of throwing his transgressing slaves alive into the pond which contained his Murænæ, expressing a brutal pleasure at being able thus to feast upon their digested remains. A young slave happening to break a crystal goblet, when the emperor was present at an entertainment given by this monster, he was ordered to be cast into the fishpool. The boy, however, in desperation, appealed to the emperor, and explained the matter to him, who was so shocked at the brutality, that he gave the boy his liberty, ordered all the crystal vessels in the house to be broken, the ponds to be filled up, and spared the wretch's life only in consideration of past familiarity. The Muræna attains the length of four or five feet, and is beautifully mottled with golden-yellow and purple; it is very voracious, and its bite is severe.

* Its Latin name.

*Gymnotus.**

In this genus, the anal fin extends under the greater part of the body, and generally to the tail, but there is no dorsal whatever; they have no scales: all the species, which are not numerous, inhabit the rivers of South America. The most singular species, and perhaps the most remarkable of all fishes, is the Electric Gymnote (*G. Electricus*). It is generally about three feet in length, but sometimes reaches that of five or six, and a circumference of two feet. The head is full of pores, from which spreads a viscous matter; other similar pores, but smaller, are found all over the body, so that when kept in confinement, it is necessary to change the water daily. Its tail is long and muscular, which it whirls about with great agility. As it has the power of communicating violent electric shocks, and of stunning the largest animals, it is much dreaded. A road near Uritucu, was obliged to be abandoned, on account of the number of mules that were yearly stunned and drowned, at a stream which it crossed. Humboldt found the shock of one greater than that of a large Leyden phial, completely charged. Having placed his feet on one, he received a terrific shock, and felt for the rest of the day a very severe pain in his knees, and all the joints of his body. As water is a conductor of electricity, a person may be struck at

* Γυμνός, *gymnos*, naked, and νῶτος, *notos*, the back; from its having no dorsal fin.

some distance, and the smaller fishes are even killed at the distance of fifteen feet. The shock increases in violence, according to the health, the activity, and especially the rage of the animal. After exerting its powers awhile, it becomes exhausted, and must recruit them by repose and nourishment. Some persons are affirmed to be exempt from its influence. The organ producing this astonishing effect, consists of two large bundles of tendinous fibres on each side, occupying the hinder part of the body ; they are crossed at right angles, by other plates of the same kind, forming a wide and deep network of minute cells, filled with a jelly-like substance :— an enormous voltaic pile. Humboldt graphically describes a display of the terrific powers possessed by these animals. “ We were greatly surprised when they informed us they were going to catch about thirty half-wild horses in the neighbouring savannahs to employ them in fishing for these Electric Eels. While our host was explaining to us this strange system of fishing, a troop of horses and mules arrived. The Indians had made a sort of enclosure around them, and, pressing them closely on all sides, forced them to enter the water. I shall but imperfectly depict the interesting spectacle presented to our view by the combat of the Eels against the horses. The Indians provided with very long reeds and harpoons, placed themselves around the basin. Some of them mounted on trees, whose branches overhung the surface of the water. They all, by their cries, and the length of their reeds, prevented the horses from attaining

the shore. The Eels, stunned and confused by the noise of the horses, defended themselves by the repeated discharge of their electric batteries. For a long time they seemed likely to gain the victory over the horses and mules; these were seen in every direction, stunned by the frequency and force of the electric shocks, to disappear under the water. Some horses, however, rose again, and, in spite of the active vigilance of the Indians, gained the shore, exhausted with fatigue; and, their limbs being benumbed with the electric commotions, they stretched themselves at full length upon the ground.

"I could have wished that a skilful painter had had the opportunity of seizing the moment when the scene was most animated. The groups of Indians surrounding the basin,—the horses with their manes bristling, terror and anguish depicted in their eyes, trying to escape the storm which surprises them,—the yellowish and livid eels, which, like huge aquatic serpents, are swimming on the surface of the water, and pursuing their enemy; all these objects presented, without doubt, the most picturesque assemblage imaginable.

"In less than five minutes, two horses were already drowned. The Eel, more than five feet long, glides under the belly of the horse; it then makes a discharge from the entire extent of its electric organ. * * * Deprived of all sensibility, they disappear under the water; the other horses and mules pass over the bodies, and they perish in a few minutes. I was afraid that the sport might termi-

nate very tragically, not doubting that by degrees the greater part of the beasts would be drowned; but the Indians assured us, that the fishing would soon be at an end, and that it is only the first assault of the *Gymnotus* that is to be dreaded. When the combat had lasted about a quarter of an hour, the mules and horses appeared less affrighted; they no longer bristled up the mane, and the eye was less expressive of suffering and fear. They were no longer seen to fall backwards; and the Eels, swimming with the body half out of the water, and now flying from the horses instead of attacking them, began themselves, in their turn, to approach the shore.”*

The Sand Launce, (*Ammodytes*† *Lancea*), common on our own shores, belongs to this Family. It has the lengthened body of the Eels, with a fin running down the back, and a forked anal. It is used chiefly for bait, but is sometimes eaten. It is about ten inches in length, of a silvery grey hue.

* Obs. de Zool.

† Ἀμμος, *ammos*, sand, δύνω, *dyno*, to dive.

ORDER V.—LOPHOBRANCHIATI.*

IN all the preceding Orders, the gills consist of a great number of thin and narrow plates, arranged in rows like the teeth of a comb ; but here they are divided into small round tufts, arranged in pairs along the gill arches ; the gill-cover, which is large and hard, is so fastened down as to leave only a small aperture. The Order is also distinguished by the slenderness of the body, and by the singularly sculptured plates in which they are enclosed, which by their regularity give these fishes an angular shape.

Syngnathus,† *the Pipe-fish.*

The most prominent character of this curious genus is, that the jaws are united together, and produced into a lengthened tube, which being turned up at the end causes the mouth to open vertically ; the ventrals are wanting ; the body covered with hard plates arranged in parallel lines. These singular fishes, of which Mr. Yarrell recognises five species as British, have a peculiarity in the economy of their reproduction, which cannot but strongly re-

* Λόφος, *lophos*, a tuft, and βράγχια, *branchea*, gills.

† Σύν, *syn*, together, and γνάθος, *gnathos*, the jaw.

mind us of the Marsupial Mammalia. It is the presence of a pouch, or false belly, found, however, strange to say, in the male only, and formed by two soft flaps which fold together. “They breed in the summer ; the females casting their roe into the false belly of the male.” Here it remains until the development of the young ; and even afterwards “the pouch probably serves as a place of shelter, to which the young ones retreat in case of danger.” Mr. Yarrell has “been assured by fishermen, that if the young were shaken out of the pouch into the water over the side of the boat, they did not swim away, but when the parent fish was held in the water in a favourable position, the young would again enter the pouch.”* These fishes appear to feed on water-insects, crustacea, spawn, &c., which they suck up through their tubular mouth.

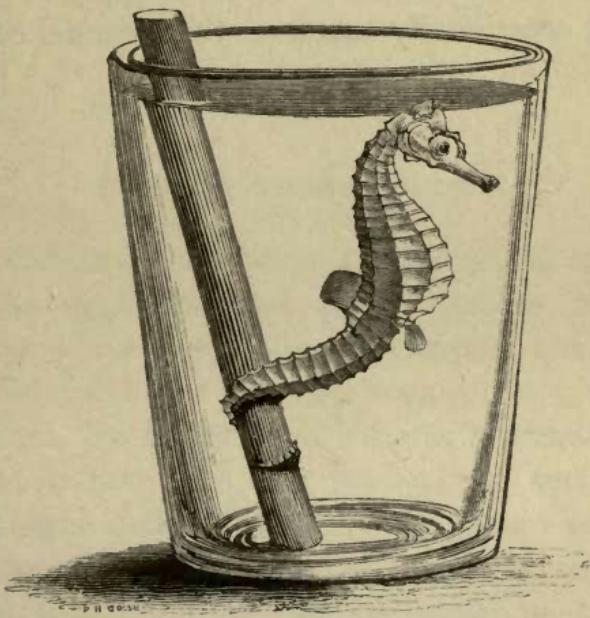
Hippocampus.†

This singular little creature, possessing but slight outward resemblance to a fish, is frequently met with in cabinets of shells, and familiarly known as the Sea-horse, the head and neck when dried assuming much of the form of a horse. With the jaws formed as in the preceding genus, the body is much flattened sidewise, and deep in the abdomen ; the whole divided into squares by transverse and longitudinal ridges, with short spines at the corners ; there are pectorals

* Br. Fishes, vol. ii. p. 329.

† “*Ιππος*, *hippos*, a horse, and *κάμπη*, *kampe*, a worm.

and a dorsal, but no ventrals nor tail-fin; an anal only in the female. The tail is taper and pointed, and has the power of grasping. They are said to be very amusing in captivity. "When swimming about, they maintain a vertical position; but the tail is ready to grasp whatever meets it in the water, quickly entwines in any direction round the weeds,



SEA-HORSE (*Hippocampus Antiquorum*).

and, when fixed, the animal intently watches the surrounding objects, and darts at its prey with great dexterity. When two approach each other, they often twist their tails together, and struggle to separate, or attach themselves to the weeds; this is done by the under part of their cheeks or chin, which is also used for raising the body when a new spot is

wanted for the tail to entwine afresh. The eyes move independently of each other, as in the Chameleon; this, with the brilliant changeable iridescence about the head, and its blue bands, forcibly reminds the observer of that animal.”*

The peculiarities of generation, noticed in the preceding genus, appear to belong to this also. The species to which the above remarks apply is *H. Brevoorti*, occasionally taken on the Channel coast.

* Mr. Lukis in Br. Fishes, ii. p. 343.

ORDER VI.—PLECTOGNATHI.*

THE jaws, which in the past Orders are free, are now so constructed that the bones of which they are composed are soldered, as it were, together, having no power of independent motion. The gill-covers and rays are concealed under a thick skin, through which there is only a small slit; there are only the vestiges of ribs, and the ventral fins are wanting.

FAM. I.—GYMNOdontidae.†

In this family the teeth are so united as to present the appearance of parallel plates internally, but the whole resembling a parrot's beak. They have the faculty of swelling themselves into a globular form, by filling their enormous stomachs with air, and in this state they float on the surface, belly upward, yet well defended by the spines with which they are everywhere covered, stiffened and erected by the inflation. In such a condition they have been compared to the burr of a chestnut. The Globe-fish (*Tetronodon Pennantii*‡) is caught on our own shores; its back is a rich blue, its belly silvery, with brown fins.

The Sun-fishes (*Cephalus Mola*, § &c.) have no

* πλέκω, *pleko*, to knit together, and γνάθος, *gnathos*, the jaw.

† Γυμνός, *gymnos*, naked, and ὀδούς, *odous*, a tooth.

‡ Τεσσαρες, *tessares*, four, and ὀδούς, *odous*, a tooth. *Pennantii*, from Pennant, an English naturalist.

§ Κεφαλή, *kephale*, the head; *mola*, a shapeless mass.

spines ; their tail is exceedingly short but high, and united to a high and pointed dorsal and anal, whence they derive a singularly grotesque appearance. They are noted for their luminous radiance at night ; and as they are of large size, four feet in diameter, and almost globular, they are said to be visible far down in the depths of ocean, and to look like great globes of red-hot iron. They occasionally appear to sleep at the surface.

FAM. II.—SCLERODERMATA.†

These are distinguished by a conical snout, prolonged from the eyes, and ending in a small mouth, armed with a few distinct teeth in each jaw. The skin is usually rough, or invested with bony plates.

Ostracion.‡

The covering of this genus is exceedingly hard, composed of numerous pieces joined with the greatest regularity, and often with a mathematical precision, in hexagonal plates. So inflexibly are these soldered together, that the only moveable parts are the tail, fins, and mouth, so that they may not unaptly be compared to the Tortoises. They are generally somewhat triangular in vertical transverse section. Some species, as *O. Cornutus*, are singularly armed with projecting spines on the head and beneath the tail. They are chiefly found in the tropical seas.

* Σκληρός, *skleros*, hard, and δέρμα, *derma*, skin.

† Ὀστρακον, *ostrakon*, a shell.

CHONDROPTERYGII,* *CARTILAGINOUS FISHES.*

While in some of the genera of this great section the general structure is so simple as to make it a subject of doubt whether they are vertebrate animals at all, others seem to manifest an approach to the Reptiles, which sets them above most of the Bony Fishes. It seems, therefore, that these two sub-classes may run parallel with each other, as the two sub-classes of Mammalia do. The skeleton is not, in this division, formed of bone but of cartilage; the earthy matter being deposited, not in the form of bony fibres, but in scattered grains. It contains two Orders.

ORDER I.—CHAUNOBRANCHIATI.†

THE genera of this first Order manifest an agreement with the Bony Fishes in their gills, which have a single wide opening, and are furnished with a gill-cover, but are destitute of rays.

Acipenser,‡ the Sturgeon.

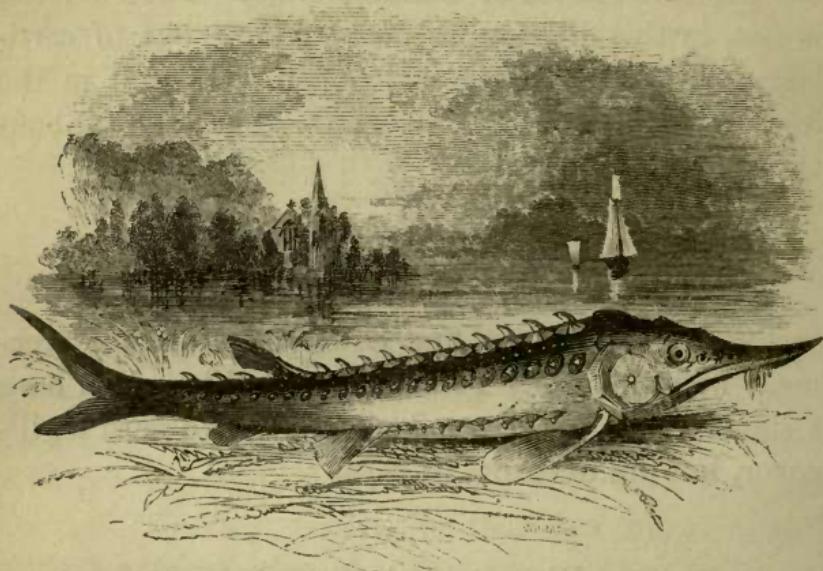
The body of the Sturgeons is much lengthened, and being covered with bony plates in rows, which

* Χόνδρος, chondros, cartilage, and πτερυξ, pteryx, a fin.

† Χαῦνος, chaunos, free, and βράγχια, branchia, gills.

‡ Its ancient Latin name.

are armed with regular spinous tubercles, it assumes an angular form. The snout is long and tapering, beneath which is placed the mouth, in the form of a fleshy tube, without teeth. The upper lobe of the tail-fin is much longer than the lower. They are usually rather large fishes, inhabiting the rivers, but annually migrating to the sea. The flesh of most of them is esteemed; the roe is converted into caviare, and the air-bladder into isinglass. The common Sturgeon (*A. Sturio*) is now and then taken



THE STURGEON (*Acipenser Sturio*).

on our coasts and in our rivers; and a few years ago, more than a hundred were brought to Billingsgate market in the course of one season. One taken in Scotland, in 1833, was eight and a half feet long,

and weighed two hundred and three pounds; but Pennant mentions one, captured in the Esk, which weighed four hundred and sixty pounds.* The flesh of the Cartilaginous Fishes generally is firmer and more compact, and more like *meat* than that of the Bony Fishes. That of the Sturgeon "is in request for the table, being generally stewed with rich gravy, and the flavour considered to be like that of veal." It spawns in the rivers during the summer months, and in the north and east of Europe is the subject of important fisheries.

A genus called *Chimæra*,† from their singular appearance, appear to be intermediate between the Sturgeons and the Sharks, agreeing with the former in having but a single external gill-opening, though as in the latter this aperture leads to five holes, and the gills are fixed by a great part of their edges: the tail ends in a long slender thread. The Northern Chimæra (*C. Monstrosa*) follows the Herring shoals for prey; it is three feet long, silvery white, beautifully marbled with rich brown.

* During the progress of this work, a large one, reported to be nine feet in length, and to weigh two hundred and eighty pounds, was taken in the Thames near Battersea.

† A fabled monster.

ORDER II.—PECTOBRANCHIATI.*

THESE differ from all other fishes, in not having the gills free on their outer edge, and opening all their intervals into a single large orifice, but adhering by that edge, so as to permit the water to escape through just so many apertures as there are intervals, or at least so that these holes terminate in a common aperture through which the water is sent.

FAM. I.—SELACHII.†

The true bones of the jaws are wanting, but their place is supplied by the bones of the palate, and some others which are armed with teeth. The ventrals are placed behind the abdomen, on each side the vent: in the males, these fins have long appendages, the use of which is not ascertained. The females in some cases bring forth living young; in others, the young are produced enclosed in leathery cases, or sacs. This family is composed of two large groups, the Sharks and the Rays.

* Πηκτός, *pektos*, fixed, and βραγχεῖα, *branchea*, gills.

† Σελαχος, *selachos*, the Greek name of the cartilaginous fishes.

α. SHARKS.

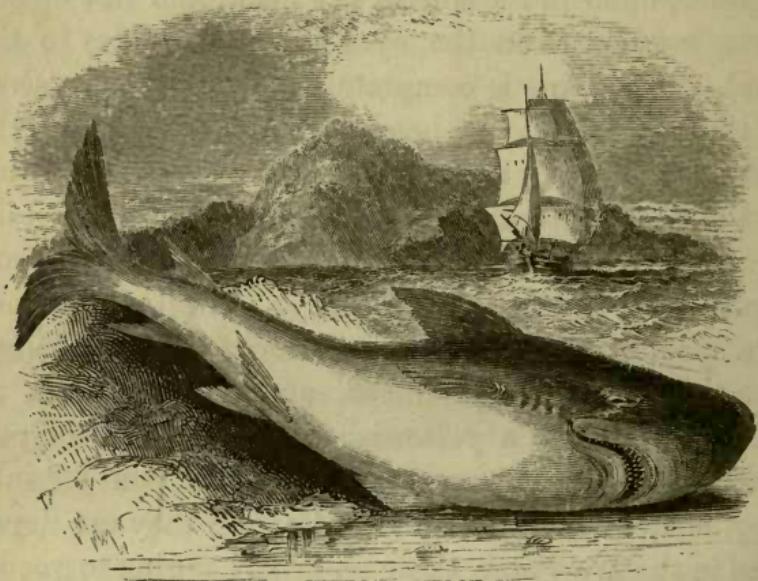
Scyllium, the Dogfish.*

A lengthened body, thick fleshy tail, and moderate sized pectorals assimilate the Sharks to ordinary fishes in outward form; the gill apertures, five in number, open in the side of the neck, and not on the under surface; and the eyes are in the sides of the head. The spine is completely divided into *vertebræ*. In the Dogfishes, the head is short and blunt; the teeth are pointed, and have a small lobe on each side of the base: two dorsals, both placed far back; tail-fin lengthened, not forked. Most of them are handsomely spotted with black, as is well seen in our rare species, the Large Spotted Dogfish (*S. Catulus*). The young, when produced, are enclosed each in a horny case, of a yellowish colour, and an oblong four-sided form, the corners of which run off into long, slender and twisted tendrils. As they are deposited in shallow water, these tendrils, hanging to weeds, enable them to maintain their situation in spite of the waves. The rough skins of these fishes are used by cabinet makers for smoothing wood. They are voracious and formidable animals.

* Σκυλάω, *skylao*, to prey; or σκύλαξ, *skylax*, a whelp; answering to *Catulus*.

Carcharias, the Shark.*

The true Sharks are celebrated in all seas for their size, strength, and carnivorous voracity; their numerous teeth, trenchant and pointed, are generally serrated at the edge, and arranged in many successive rows, presenting a most formidable apparatus of destruction; the snout is prominent, projecting far



WHITE SHARK (*Carcharias Vulgaris*).

over the mouth; the tail fin is somewhat forked; the pectorals and first dorsals very large and powerful. The White Shark (*C. Vulgaris*) is the most terrific monster that inhabits the deep; its length is frequently twenty-five feet, and its jaws,

* Καρχάρος, *karcharos*, rough.

bristling with six rows of lancet-like teeth, are moved with a muscular power, sufficient to cut a man asunder at one effort; and as it is almost constantly prowling around vessels in tropical climates, it is universally regarded by mariners with uncontrollable horror and aversion. Our books of Natural History teem with anecdotes of the fatal voracity of this dreadful animal; men have been found whole in its capacious maw, and so indiscriminate is its appetite, that it spares not its own species. Leems relates, that a Laplander having caught a Shark fastened it to his canoe: he presently missed it, without being aware how it had gone; in a short time he caught another of a larger size, in which when opened, he found the one which he had first taken. In Beaufoy's Mexican Illustrations, a sickening narrative is given. "A British sloop of war, containing a lieutenant, two midshipmen, and thirty-two sailors was capsized off Cuba. The poor fellows hung about the wreck till the Sharks collected, and began to fight for their prey. The first bitten, was the lieutenant, whose leg was taken off above the knee. He was soon torn to pieces, and others quickly shared the same fate. A young midshipman was pushed up on a part of the wreck where the Sharks could not reach; one seaman swam off, and thinks he frightened the voracious animals, by splashing the water, but more probably they remained where their victims were more numerous. The seaman was picked up by an American vessel, which also put about and saved the midshipman. On this horrible

occasion, thirty-three human beings were dragged off one by one, and devoured." In spite, however, of the ravenous character and great strength of the Shark, "the divers in the East Indian pearl-fisheries, think little of entering the lists against him, armed with a strong piece of wood sharpened at both ends. Awaiting the opening of his enormous mouth, they thrust in their arm, holding the wood perpendicularly, and his mouth being thus kept extended, he drowns."

A most singular conformation is found in a genus of Sharks named *Zygæna*,* the Hammer-headed Shark. The head is short, but enormously widened, a large portion projecting on each side, like the head of a hammer, or maul; the eyes are placed at each extremity. One species (*Z. Malleus*) is found in the European seas.

Pristis,† *the Saw-fish.*

This genus approaches the Rays in the form of its body, which is flattened before, and in its gill-aperatures opening beneath. It is remarkable for a very long, thin, and flattened snout, resembling the blade of a sword, armed on each side with a row of bony, sharp, and cutting spines, implanted like teeth. Their true teeth are small, and set like paving stones. They attack the Whale with their terrific weapon, and inflict dreadful wounds. Captain Crow says, that they even fight the White Shark, and often kill him; he

* Ζυγὸν, zygon, a yoke.

† Πρίστις, prizo, to saw.

has seen a Shark leap from the water, and fall into a boat, much lacerated by a Saw-fish. The Mediterranean species (*P. Antiquorum*) attains a great length.

Squatina, the Angel.*

Intermediate between the Sharks and Rays, the Angels, or Monk-fishes as they are also called, have the mouth at the end of the snout, instead of beneath, and the eyes on the upper part of the head: the body is broad and flat, and the pectorals so large, as to have given the name of Angel, as if winged. They grovel on the bottom, where they voraciously prey on the small Flat-fish.

β. RAYS.

Rhinobatus, the Shark-ray.

The Rays or Skates are strongly marked by their flattened, and more or less lozenge-shaped bodies, caused by the immense size of their pectorals, which are united in front of the head, and extend back to the commencement of the ventrals. The eyes are situated on the upper surface, the mouth, nostrils, and gill-apertures on the lower. The dorsals are usually on the tail. The Rays appear to represent the true Flat-fishes, to which they have many points of resemblance.

There seems, at first sight, to be a great difference

* *Squatina*, Lat. a Skate. † *Pίνη, rhine*, a Skate, and *βάτος, batos*, a thorn.

between a Shark and a Ray in form, and yet we have seen in the last two genera a gradual blending of the characters, till it is not easy to determine, without close examination, to which of the two groups the fish is to be referred. And still more is this the case with the genus before us; the first of the Rays, placed here because apparently possessing a predominance of the characters which distinguish the latter. The ancients considered the *Rhinobatus* as a cross breed, produced by the Angel and the Ray.

Torpedo, the Electric Ray.*

The form of the body differs from other Rays in being nearly circular; the tail is comparatively short; and the skin is smooth. It has been celebrated from the earliest times for its power of communicating an electric shock, similar, though inferior in force, to that of the *Gymnotus*. The organs producing this effect, are situated one on each side of the gills, and are composed of a great number of tubes placed perpendicularly, and when cut across, resembling a honeycomb; these are divided into cells, and are filled with mucus. The use of this power, is supposed to be the hastening of decomposition in its prey, and consequent digestion. A species has been occasionally taken on the English coasts, where it is called the Cramp-fish.

* *Torpeo*, to benumb.

Raia, the Skate.*

The true Rays present most obviously the characters we have already mentioned; their disk is rhomboidal, their tail long and slender, and furnished near the tip with two small dorsals; on the tail are usually one or more rows of sharp points, and in some species the whole disk is studded with points rising from a broad base, and resembling the spines of a rose, as in the common Thornback (*R. Clavata*). A Skate's "mode of defending itself, as described by Mr. Couch, is very effectual: the point of the nose and the base of the tail are bent upwards towards each other; the upper surface of the body being then concave, the tail is lashed about in all directions over it, and the rows of sharp spines frequently inflict severe wounds."† The young of the Rays are produced in horny cases resembling those of the Sharks.

Trygon,‡ the Sting-ray.

This genus is distinguished from the common Rays by the tail being armed near the base with a very hard and sharp-pointed spine, with serrated edges; the rest of the tail is slender, and tapers to a long point without any fin. A species called the Fire Flaire (*T. Pastinaca*§) is now and then

* Its Latin name.

† Yarrell, Br. Fish. ii. 415.

‡ Its Greek name.

§ *Pastinum*, a two-pronged fork?

taken on our southern coast, where it is dreaded as venomous, though this appears to be groundless. “The manner in which it defends itself shows its consciousness of the formidable weapon it carries on its tail. When seized or terrified, its habit is to twist its long, slender, and flexible tail round the object of attack, and with the serrated spine tear the surface, lacerating it in a manner calculated to produce violent inflammation. Other authors state that it is capable of striking its weapon with the swiftness of an arrow into its prey or its enemy, when with its winding tail it secures its capture.”*

Cephaloptera.†

A gigantic and formidable genus, remarkable for the pectorals, instead of enclosing the head, projecting forwards into two curved points like horns. The pectorals are of great width, and the form is much wider than long; the tail is, however, long and slender, furnished with a small dorsal at its base, and a serrated spine immediately behind it. Colonel Hamilton Smith witnessed the destruction of a soldier by one of these gigantic creatures, off Trinidad. It was supposed that the soldier, being a good swimmer, was attempting to desert from the ship. The circumstance occurred soon after daylight; and the man being alarmed by the call

* Yarrell, Br. Fish. ii. 443.

† Κεφαλὴ, *kephale*, the head, and πτέρον, *pteron*, a wing.

of a sailor in the main-crosstrees, endeavoured to return to the vessel, but the monster threw one of his fins over him and carried him down. Le Vail-lant saw one twenty-five feet long and more than thirty wide; and Sonnini says, one appeared larger and wider than the ship in which he was sailing.*

FAM. II.—CYCLOSTOMI.†

We have now arrived at the limit of the Vertebrate form of animal life. The SUCKERS exhibit the lowest organisation and most rudimentary skeleton of all creatures that are built upon a bony framework. Their spine, a mere tube of rings, enclosing a mucilaginous cord, can scarcely be considered solid enough for cartilage, and they have no real ribs. They have neither pectoral nor ventral fins; their bodies are long and worm-like, the fore-part ending in a round, or half-round, fleshy lip, supported by a ring of cartilage. The gills take the form of purses or cells, usually opening by seven apertures on each side.

Petromyzon,‡ the Lamprey.

This finely-tasted, but luscious and rather unwholesome fish, resembles an Eel, or a Muræna,

* Griffith's Anim. Kingd. x. p. 654.

† Κύκλος, *kyklos*, a circle, and στόμα, *stoma*, a mouth.

‡ Πέτρος, *petros*, a stone, and μύζω, *myzo*, to suck.

in its lengthened cylindrical form, and smooth slimy surface ; its circular mouth is beset with scattered teeth arranged round the throat, and acts as a powerful sucker, by means of which the animal attaches itself to rocks or stones to procure stability, and to the bodies of other fishes, into which it eats away to the bones. Another use is also assigned to it. “ They are not furnished with any elongation of the jaw, afforded to most of our fresh-water fish, to form the receiving furrows at the important season of spawning ; but the want is supplied by their sucker-like mouth, by which they individually remove each stone. Their power is immense : stones of a very large size are transported, and a large furrow is soon formed.”* When the sucker is attached to any object, and the mouth is closed, the water is still respired, entering the gills by the same apertures as it is ejected : and in the respiration being thus independent of the mouth, they resemble the *Cephalopoda*. Three or four species are British, of which the Lamprey (*P. Marinus*) and the Lampern (*P. Fluvialis*) are most esteemed : both are taken in the Thames. The Sand-pride (*Ammocetes*† *Branchialis*) has all the parts which should constitute the skeleton, so soft and membranous, that they are hardly entitled to the name of cartilage. Its upper lip is half round, and its under lip transverse, so that it does not adhere,

* Jardine, quoted in Br. Fishes, ii. 451.

† Ἀμμος, ammos, sand, and κοιτη, koite, a bed.

but burrows in mud like worms, which in general habits it much resembles. It is not larger than a quill.

Myxine, the Hag.*

This worm-like fish has a mouth furnished with one hooked tooth, but the tongue has two rows of teeth on each side; the lips are surrounded with eight *cirri*, or feelers; the gill-apertures, which are two, are placed under the breast. Instead of a spine, composed of a series of joints, there is merely a soft and flexible cartilaginous tube; the eyes are wanting. From pores along the under surface, a thick mucous secretion exudes in great quantity at pleasure, by means of which it probably conceals itself when devouring prey. Kalm having put a Hag (*M. Glutinosa*) into a large tub of sea-water, it became like a clear thick glue, from which he could draw threads, even moving the animal with them. A second water, upon its being again immersed, in a quarter of an hour became the same. Mr. Yarrell observes, "It is impossible to dissect a Myxine, and attend to the structure and substance of its investing skin, without being forcibly reminded of its great resemblance to the investing mantle of the Cephalopods." And again, "The relation to the Cephalopods is apparent in the eight tentacula, or feelers, about the head, the horny but flexible nature of the columnar support of the body, the character of its external covering,

* Μύξη, *myxa*, mucus.

and by the power of ejecting a copious secretion whenever it considers itself in danger.”*

We have quoted these observations the more readily, and dwelt with the more minuteness on these forms, because the transition from the Vertebrated animals to those which are destitute of a skeleton is most important and interesting; for it must be borne in mind, that the relations we are considering are not those of two allied genera or orders, or even classes, but those which connect two great divisions of the Animal Kingdom, apparently separated by a broadly distinct line of demarcation.

Amphioxus,† the Lancelet.

We cannot refrain from noticing this interesting little creature, one of the smallest as well as the lowest of vertebrated animals, of which the only known specimen is in the museum of Mr. Yarrell. It is about an inch and a half in length, transparent, pointed at each extremity, without eyes, jaws, or teeth; having a mouth opening like a line beneath the head, furnished on each side with slender filaments. The skeleton is still more rudimentary than in the *Myxine*, being “reduced to a small and slender semi-transparent column, extending throughout and connecting the whole length of the body, like the flexible horny pen in some species of Cephalopods.”‡

* Br. Fishes, ii. p. 466.

† Ἀμφίξης, *amphis*, both ways, and ὀξύς, *oxus*, sharp.

‡ Yarrell.

Thus we have seen the bony skeleton, the scaffolding on which the whole structure of the animal is built, gradually changing from the dense and solid character which it assumes in the Birds and Mammals, to the tough and flexible bones of the proper Fishes, thence to the gristle of the Sharks and Rays, and finally to a form and texture scarcely distinguishable from the vestige which still lingers in the highest of the INVERTEBRATA.

SECOND GREAT DIVISION.

MOLLUSCA.*

THE jointed and bony skeleton has now, as we have seen, disappeared; the nervous matter, the source and centre of all sensation, is no longer concentrated into a great mass at the end of a single column, but scattered in knots, called *ganglia*, in different parts of the body. One large ganglion, however, situated upon the throat (*œsophagus*), and giving out nerves to the organs of sense, undoubtedly answers to the brain of superior animals; and all the scattered masses, while giving out nerves to various parts of the body, communicate with this principal ganglion.

“ Various are the forms and widely different the relative perfection of the Mollusca, as regards their endowments and capabilities. Some, as the Barnacles, (*Cirrhopoda*), fixed to the surface of various sub-marine bodies, either immoveably or by the intervention of a flexible pedicle, entirely deprived of organs connected with the higher senses, and unable to change their position, are content to cast out at intervals their ciliated arms, and thus entrap

* *Mollis*, soft.

such passing prey as suits their appetite. Others, equally incapable of locomotion, but furnished with arms of different construction, (*Brachiopoda*,) catch their food by similar efforts. The *Tunicata*, enclosed in coriaceous bags, are firmly rooted to the rocks; or, aggregated into singular compound masses, float at the mercy of the waves. The *Conchifera* inhabit bivalve shells; while the *Gasteropod* orders, likewise defended in most cases by a shelly covering, creep upon a broad and fleshy ventral disk, and thus endowed with a locomotive apparatus, exhibit senses of proportionate perfection. The *Pteropoda* swim in myriads through the sea, supported on two fleshy fins; while the *Cephalopod Mollusca*, the most active and highly organized of this large and important division of animated nature, furnished with both eyes and ears, and armed with formidable means of destroying prey, become tyrants of the deep, and gradually conduct us to the most exalted type of animal existence."*

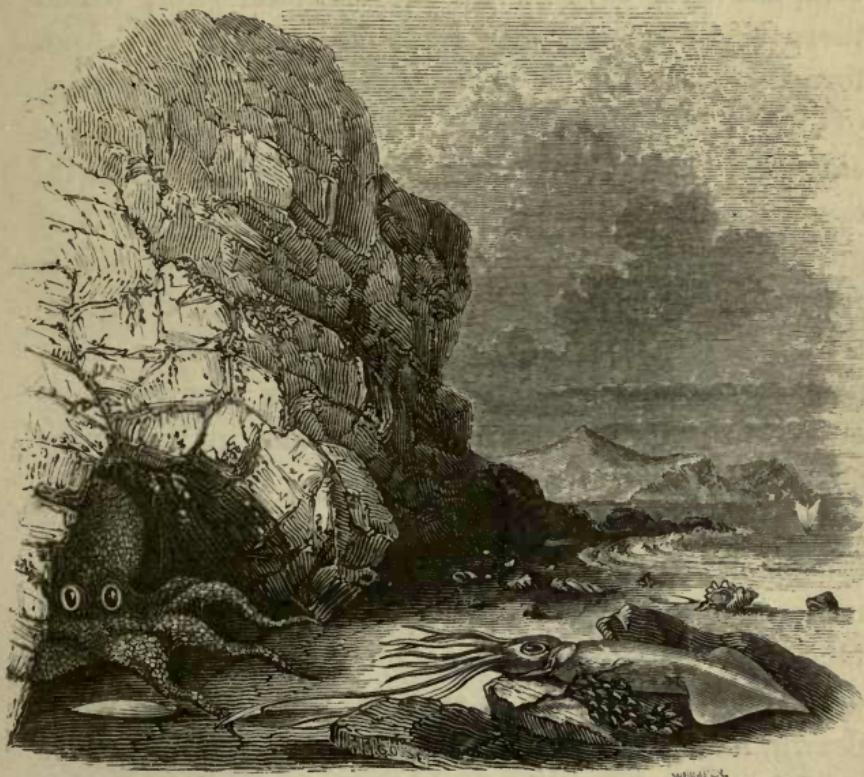
In most of the Mollusca, the skin is developed into a sort of mantle, which assumes various forms; it is often narrowed into a simple disk, formed into a pipe, hollowed into a sac, or divided into fins. Often in the thickness of the mantle a plate is formed of different degrees of hardness, which seems to bear some analogy to the spine of vertebrate animals. Generally, however, it becomes so large, that the animal is able to shelter itself beneath it; it is then termed a *shell*, the covering skin of which

* Jones's Anim. Kingd. p. 351.

becomes exceedingly thin, and often dried and withered. The shells of Testaceous Mollusca frequently display great elegance of form, fineness of texture, and brilliancy of colouring; they always consist of matter deposited in layers, and secreted from the skin, on that surface next the interior of the body.

The *Mollusca* are arranged in six Classes, according to the various modification of their organs.

CLASS I.—CEPHALOPODA.*



THE POULPE (*Octopus Vulgaris*), AND THE CALAMARY (*Loligo Vulgaris*).

CONTAINING but a single Order, the first Class of Molluscous animals is composed of those whose mantle forms a sort of fleshy bag, varying in shape, which contains the viscera. It is surmounted by

* Κεφαλὴ, *kephale*, the head, and πούς, *pous*, the foot.

a large head, flattened at the top into a sort of disk, in the centre of which is a beak almost exactly resembling in form, texture, and action, that of a Parrot, save that the upper mandible shuts into the lower. On each side of the head is a large and complex eye, covered by the common skin, which there becomes perfectly transparent, and, by a fold, forms eyelids for its protection. Around the edge of the disk, between the beak and the eyes, are eight or more fleshy arms, usually of great length, tapering to a point; they are very flexible, but of great muscular power, and their under surface is furnished with many suckers of curious construction. Each sucker may be compared to a most perfect cupping-glass, consisting of a circular muscular cup, whose concave surface has in its centre an aperture leading into a cavity; a piston accurately fits the orifice, which may be withdrawn by muscular force. The animal, then, in throwing out its long flexible arms, brings one of them into contact with its prey; the instant the concave surface of but a single sucker is applied, the piston is withdrawn, and a vacuum is created, and by the atmospheric pressure without, the sucker adheres with astonishing force. But, as the suckers are numerous and close, many are made to adhere at one moment; the arm is swiftly twined round the object, and the other arms being likewise applied to it, it is easier to tear asunder the muscular fibres of the limb than to loosen the fearful and often fatal embrace. With all this adhesive power, which is

very strong even after death, the animal can in an instant loose its grasp, and retire in case of danger, by simply pushing forward the piston and filling the vacuum. The power with which these arms are endowed, and the strength of the sharp and horny beak, render the *Cephalopoda* truly formidable opponents, especially as they are carnivorous, and their courage and cunning are equal to their rapacity.

These arms are not only prehensile weapons, but act as feet, the animal crawling upon them with the beak towards the ground and the body elevated, with a vacillating motion, as might be imagined from the flexible nature of the supports.* By the broad disk formed by the union of their bases, the animal is also enabled to swim with considerable facility, but in a backward direction. Two gills, resembling fern-leaves, are placed within the sac, which, receiving water through a valve, eject it through a funnel-shaped aperture situated at the back of the head. So forcibly is the respired water thus expelled, that it is one of the ordinary means of motion, the jets serving to dart the animal by successive jerks backward through the sea. The blood purified in these gills, is carried to two hearts, one on each side, and from thence to a third central heart, whence it is distributed through the arteries of the body. One of the most curious circumstances connected with the economy of the *Cephalopoda*, is the secretion of a peculiar fluid of a most intense blackness, lodged in a vessel, variously situated in

* See the figure of the Poulpe, at the head of this Class.

different species, and spouted out at the will of the animal, in surprising abundance, through the funnel. This substance, frequently called ink, from the use to which it was anciently applied, mixes freely with the water, diffusing an impenetrable obscurity for some distance around, by which the animal often escapes from danger; thus, as our illustrious Ray wittily remarked, hiding itself, like an obscure and prolix author, under its own ink. When dried, this substance affords an excellent pigment, and it has been supposed to be the material of the celebrated Indian ink of China, but this is very doubtful. Its qualities seem incapable of destruction by age; for Dr. Buckland, having presented some which was found in fossil specimens to a celebrated painter, was eagerly asked, "From what colourman he could procure more of a sepia so excellent!" The skin of those *Cephalopoda* which are unfurnished with an external shell is of changeable hues, brightening and fading in spots more rapidly than that of the Chameleon.

It is rather singular that the food seized by the parrot-like beak should be conveyed to a crop, and thence to a real muscular gizzard, like that of a fowl. Besides the horny or shelly column already noticed, we discover another vestige of a skeleton in a cartilaginous case which encloses the great ganglion, or brain, and represents the skull of superior animals; other pieces of cartilage, but scattered and unconnected, seem to represent the more important bones.

The young in this Class are produced from eggs, which are found adhering together in clusters of diverse appearance in different species. Those of the common Cuttle-fish (*Sepia Officinalis*) resemble a bunch of black grapes, with their foot-stalks; while those of the Calamary (*Loligo Vulgaris*) are enclosed in many long jelly-like tubes. The species are numerous and are found in almost every sea.

Octopus, the Poulpe.*

In the first genus of this Class we find no external shell, nor internal plate; the sac, being likewise destitute of fins, is a mere oval purse, capable of being somewhat lengthened or contracted; there are eight arms, nearly equal, of great size, united at the base; the eyes are unusually small; the ink-bag is seated in the liver; the suckers are disposed in two rows along the under surface of the arms. Notwithstanding the absence of any fin-like expansion of the sac, it appears that the Poulpe has the power of swimming with considerable rapidity by working its long arms, and especially by flapping the membranous disk formed by the union of their bases. Yet its more usual mode of progression appears to be by crawling upon its fleshy arms, either at the bottom, or among the rocks of the coast, in the recesses of which it lies in wait for its prey. Crabs, Lobsters, and other *Crustacea* are thus seized, and dragged to the crooked beak, against

* Ὀκτὼ, okto, eight, and πούς, pouς, a foot.

whose ruthless gripe their shell affords a very insufficient protection. When enraged, it appears the Poulpe will not scruple to attack man himself, and proves on such occasions a most formidable adversary. Mr. Beale has described an encounter which he had with a Cephalopod, probably of this genus, while occupied in searching for shells among the rocks of the Bonin Islands. He was much astonished at seeing at his feet a most extraordinary looking animal, crawling towards the surf, which it had only just left. It was creeping on its eight legs, which, from their soft and flexible nature, bent considerably under the weight of its body, so that it was lifted by the efforts of its tentacula only a small distance from the rocks. It appeared much alarmed at seeing him, and made every effort to escape. Mr. Beale endeavoured to stop it by pressing on one of its legs with his foot; but, although he used considerable force for that purpose, its strength was so great that it several times liberated its member in spite of all the efforts he could employ on the wet and slippery rocks. He then laid hold on one of the tentacles with his hand, and held it firmly, so that it appeared as if the limb would be torn asunder by the united efforts of himself and the creature. He then gave it a powerful jerk, wishing to disengage it from the rocks to which it clung so forcibly by its suckers. This effort it effectually resisted; but, the moment after, the apparently enraged animal lifted its head with its large projecting eyes, and loosing its hold of the

rocks, suddenly sprang upon Mr. Beale's arm, (which he had previously bared to the shoulder for the purpose of thrusting it into holes in the rocks after shells,) and clung to it by means of its suckers with great power, endeavouring to get its beak, which could now be seen between the roots of its arms, in a position to bite. A sensation of horror pervaded his whole frame, when he found that this monstrous animal had fixed itself so firmly on his arm. He describes its cold slimy grasp as extremely sickening ; and he loudly called to the captain, who was similarly engaged at some distance, to come and release him from his disgusting assailant. The captain quickly came ; and taking him down to the boat, during which time Mr. Beale was employed in keeping the beak of the *Octopus* away from his hand, soon released him by destroying his tormentor with the boat-knife, when he disengaged it by portions at a time. This Cephalopod measured across its expanded arms about four feet, while its body was not bigger than a man's fist. The species is usually called by the whalers the Rock Squid.*

The common Poulpe (*O. Vulgaris*) of our own shores, bears upon each of its long arms a hundred and twenty pairs of suckers, making the astonishing aggregate of nearly two thousand in all. Their application to the human skin, is said to cause inflammation and subsequent pain. It has the reputation of being occasionally highly luminous ; Linnaeus quotes Bartholinus, who says of one, that it shone so, " that

* Hist. of the Sperm Whale.

the whole palace seemed to be on fire."* It infests the coasts of Europe, destroying an immense number of fishes and crustaceans, and is said even to have drowned persons bathing, by entwining them in its foul embrace. Its flesh is occasionally used as human food, but is so hard and tough, that it has to be well pounded to render it tolerably digestible. It has been rather vaguely asserted, that some species of this genus attain a very vast size in the Indian seas, and are able to swamp a boat, by throwing over it their immense arms; but these reports have not as yet been confirmed by the observation of any modern naturalist.

Loligo, the Calamary.*

This genus differs materially in form and structure from the last. The eight arms are more cylindrical in form, and have their cup-shaped suckers raised on short foot stalks; and besides these, there is an additional pair, of vastly superior length, but very slender, furnished with suckers only near the tips, where they are dilated into long, flat, feather-shaped disks; these longer tentacles are sometimes, for distinction, termed the feet, and are said to be employed as cables, by which the animal rides securely, fast to the rocks in a tempestuous sea. The body is adapted for swimming, by being possessed of two broad fins on each side of the lower part of the sac: the general form

* "Ut totum palantium ardere videretur."

† Its ancient Latin name.

is lengthened, and comparatively slender. Imbedded in the fleshy mantle, but so totally unconnected, that on slitting up the back it immediately falls out, is found a long thin transparent plate of cartilage, dilated at one end, and tapering to a point, and at the other somewhat cylindrical, and thus bearing no small resemblance to a pen, both in the barrel and feather. This curious support, (*calamus*, a pen,) seems to have given the name of Calamary to the genus.

The Pen-fish, or common Calamary (*L. Vulgaris*), is the best known species of the genus: the body is somewhat pellucid, of a greenish hue, changeable to dirty brown; the eyes are large and lustrous, of an emerald green, phosphoric and fiery in a high degree. It is common in the European seas, though less abundant than the Poulpe or the Cuttle, and was not unknown to the ancient Greeks and Romans. It is distinguished as a species, by the fins forming a lozenge at the extremity of the sac. "It is a very prolific animal; and the eggs are of a very singular and curious appearance: they are deposited in the form of numerous lengthened groups, radiating from a common centre, and spreading every way into a circular form; each egg is of a glassy transparency, and the young animal may be very distinctly observed in each, many days before the period of exclusion. These groups of the eggs of the Calamary are often seen swimming on the surface, and are occasionally thrown on shore; the whole group sometimes measures more than a foot in diameter, and from its

general appearance, unless closely inspected, is often mistaken for a species of Medusa, or Sea Blubber."*

Though the *Cephalopoda* are voracious destroyers of fishes, it appears that some species at least form part of the natural food of fishes. The Squid of the coast of Newfoundland, a species of *Loligo*, is very extensively used as bait for the Cod-fisheries, and is more successful in its season than any other. To procure the Squid, men go out in boats in July and August to a certain part of the harbour, where the animal is always more abundant than at any other spot; they are provided with Squid-jiggers, a formidable apparatus consisting of about a dozen hooks, three inches long, so soldered together in the shank, that the points radiate in all directions. These are not baited, but dropped into the water, one line in each hand, and are jerked up and down with an uniform motion. To see from the shore a line of boats, with a hundred and fifty men standing side by side, all with their elbows see-sawing together, is quite amusing. The animals are hooked of course in any part of the body, and when drawn up from the water, their first impulse is to eject their copious stream of ink. This is done in about a quarter of a minute after leaving the water, and the fishermen, from long habit, are sufficiently expert to take them from the jigger, and throw them into the boat before they perform this action, or to hold them in such a manner, that the funnel shall point outward, and the liquor be discharged into the sea. A slight warning is given,

* Shaw, Zool. Lect. ii. p. 133.

however, by a contraction of the animal, the moment previous. A novice at the employment, is sure to be grievously defiled. An amusing anecdote was current, when we were in the island, of a young captain, making some pretensions to fashion, having been decoyed by some rogues of fishermen to accompany them one morning on a Squid-jigging excursion. Utterly unconscious of this peculiarity he went, and the wicked fellows suffered him with much complacency to draw up the first Squid : but lo ! in taking it from the hooks, a torrent of ink was poured over his face, frilled shirt, and white waistcoat, descending in long streams even to his boots. It needs scarcely to be observed, that this votary of the Graces henceforward relinquished Squid-jigging to more congenial souls.

It seems to be a species of this genus, which under the name of Flying-Squid, is mentioned by Mr. F. D. Bennett, as numerous in the vicinity of the Sandwich Islands, where it is considered a luxury by all classes, and when fresh and well cooked, is excellent food, in consistence and flavour not unlike a lobster's claw. This species has the power of taking flying leaps out of its native element;—Mr. Bennett says, that in lat. 28° . to 31° . N., long. 154° . to 161° . W., Flying-fish, and (nearly allied to these in their movements) Flying Squid, were also numerous. During a calm, the latter appeared in larger flights than they had ever before witnessed, persecuted probably by the Albicore; they rose from the sea in large flocks, leaping over its smooth surface, much

in the same manner, and to the same height and distance, as the Flying-fish. Many of them were captured by birds during their leaps; and one individual, in making a desperate effort to escape some aquatic pursuer, sprang to a considerable height above the bulwarks of the ship, and fell with violence on the deck.*

Onychoteuthis,† *the Hooked Squid.*

This very powerful and formidable genus has much general resemblance in form to the Calamaries, but there is a peculiar structure in its adhesive apparatus, which greatly increases its powers. The suckers which arm the expanded extremities of the long feet have a projecting sharp claw in the centre of each cup, which is curved backward. On the smooth and glossy scales of fishes, lubricated with slime, it might not be always easy at once to create a vacuum, but these hooks are plunged by the action of the sucker into the flesh of the struggling victim, whereby a firm hold is obtained, and the prey is dragged to the powerful beak. Besides this, however, there is an additional provision made for the requirements of this wonderful creature: at the base of the fleshy expansions alluded to as being thus formidably armed, is a group of simple adhesive disks, which being placed in contact with each other, the two arms adhere at this point with much force, and being

* Whaling Voyage round the Globe.

† ὄνυξ, onyx, a claw, and τευθίς, teuthis, a calamary.

thus locked together, have more power in holding struggling prey, than they could have separately and singly: a structure that art has endeavoured to imitate, in the formation of a valuable and effective surgical implement. Some species of this genus attain a vast size: one, which was found dead by Sir Joseph Banks in one of the Polynesian Islands, must have measured six feet in length. The natives of those islands live in great dread of them.

Sepia, the Cuttle.*

With the two long feet in addition to the eight arms, which characterize the *Loligo*, the Cuttle has a rounder and more robust figure, and is furnished with a fleshy fin, running down the whole of each side. The plate is hard and shelly in its texture, but one side is composed of exceedingly delicate layers of shelly matter, standing up perpendicularly to the plate, at some little distance from each other, and kept apart by innumerable little pillars, invisible without the aid of a microscope. In consequence of this structure, it is so light, as to contribute to the buoyancy of the animal in water. The form of the whole is oval, and slightly convex on both surfaces. It is chiefly used to polish the soft metals: the eggs of the Cuttle are frequently found cast on shore, or fastened to sea-weeds, or rocks: they are often called sea-grapes: and, indeed, it is no unapt comparison, for they much resemble a clus-

* Its ancient name with the Greeks.

ter of black grapes, being of about the same size, black, oval, but sharp at the end, and united to each other in bunches by means of footstalks. The young are perfectly formed on their exclusion. The ink is said to be of a more intense blackness than that of other genera, and its bag is situated deep in the body.

The common Cuttle, (*S. Officinalis*), numerous on our coasts, is about a foot long in the body ; smooth and whitish, with red dots, sometimes purple. The eye of this species is very strong and hard, and when extracted is of a brilliant pearly tint ; in some parts of Southern Europe, they are worn in necklaces instead of pearls. It is exceedingly fierce and voracious, and from its depredations on the fishes enclosed in floating nets, is a source of great annoyance and serious loss to the fisherman. From its wariness and agility, however, it is difficult of capture. The author of the article "CEPHALOPODA," in the Penny Cyclopædia, observes, — " We well remember in our youth, going far out with an old fisherman of Dawlish, to visit his floating nets, which he had laid for the Pilchards. As we looked down into the clear blue water, we could see that the number of fish entangled was great ; but to the great discomfiture of the fisherman, who was eloquent on the occasion, almost every other fish was locked in the embraces of a Cuttle-fish, plying his parrot-like mandibles to some purpose. The fisherman, who seemed to regard these unbidden guests as an incarnation of all evil, carried a capa-

cious landing-net, but so quick was the sight of these Cephalopods, so ready were they in letting go, and agile in darting back or sideways, clear of the net, that though the greedy creatures held on to the last moment, the fisherman did not secure above three out of the crowds that had spoiled his haul."* The Cuttle-fish is said occasionally to use its power of ejecting its ink as a means of offence, as well as a cover for retreat. "A gallant officer, who was inconsiderately collecting shells in a pair of immaculate white trowsers, came suddenly upon one of the naked Cephalopods, snugly harboured in a recess in the rock. They looked at each other; and the Cuttle, who had his eyes about him, and knew well how to use them, upon seeing the enemy advance, took good aim, and shot so true, that he covered the snowy inexpressibles with the contents of his ink bag, and rendered them unpresentable either in drawing-room or dining-room."†

Argonauta,‡ *the Paper Nautilus.*

This genus, so celebrated for its nautical powers, from a very remote antiquity, is distinguished from all the preceding, by inhabiting a capacious shell of an uncommonly elegant shape, resembling a kind of boat, slightly flattened sideways, and turning up at the poop with a spiral curve. Its texture

* Penny Cyc. Art. CEPHALOPODA.

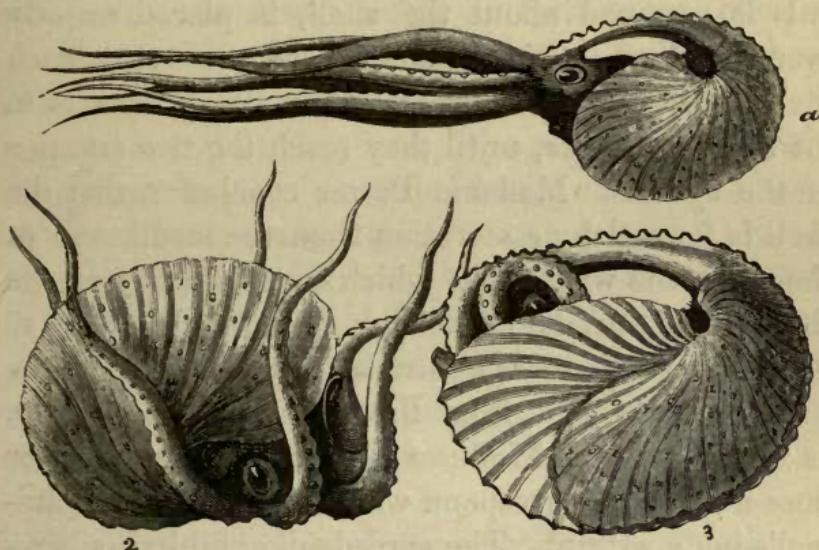
† Ibid. Art. SEPIADÆ.

‡ From the Ship ARGO.

is extremely delicate, as thin as paper, white and pellucid; its whole surface is marked by deep transverse furrows. The animal is allied to the genus *Octopus*, as it wants the two lengthened feet which distinguish the other genera, but the two arms next the back are expanded at the tips into broad fleshy disks, whose use we shall presently see. It has been poetically assumed, that man first learned the art of navigation from the inmates of these fragile barks, which may be frequently seen floating on the calm surface of the Mediterranean, with the broad disked arms expanded as sails, and the slender ones used for rowing, or at least hanging over the side. The animal, however, has no muscular attachment to its beautiful shell, but has the power of forsaking it at pleasure, and of resuming it; whence it was long supposed that it was not the original fabricator, but a hermit who had taken possession of an empty lodging, if not a cruel pirate, who had murdered the real inhabitant, and seized his vessel. But the experiments and observations of Madame Power, and M. Rang, have at length proved, to the satisfaction of naturalists, that this shell is the natural cover of the Poulpe, as well as given many interesting notices of its powers and habits. Madame Power made public her observations in 1836. Residing at Messina, she had ample opportunities of investigating the history of the Argonauts, (*A. Argo*,) which she collected of various sizes, and enclosed them in cages, which being placed in the sea, admitted the water between their bars. Every two or

three days she fed them with naked or testaceous Mollusca. She describes the Poulpe, as "furnished with eight arms, having on each two rows of suckers; the first two arms more robust, serving as masts to support the sails, which being spread out, act before the wind as such. At the base, they have, on

I



THE PAPER NAUTILUS (*Argonauta Argo*). *Fig. 1*, Swimming towards the point *a*; *2*, walking on the bottom; *3*, contracted within the shell, which is partly embraced by the arms.

the inferior side, a double row of suckers like the other six: but from the inferior row, about one inch from the base in adults, a furrowed membrane begins to develop itself, which extends to the tip of the arm, and, holding it bent, it can no longer execute the office of a rowing arm, but is employed by the animal as a sail. These sails are so large, that, when turned backwards and pressed against the

shell, they can entirely cover and protect it. Thus, it appears, the true office of these sails is exactly that of keeping themselves applied to the shell at all times, in reserve for the moment when the animal coming to the surface removes them, and spreading them, raises them as sails. In fact, the series of suckers on the sail-arms, when the membrane of the sails is wrapped about the shell, is placed exactly over the keel of it in such a manner that each sucker corresponds to each point in which the ribs of the shell terminate, until they reach the two margins of the spiral." Madame Power concludes, that the shell is formed by a secretion from the membrane of the sails, the wrinkles of which cause the ribs of the shell; and thus is explained the singular fact, so puzzling to former naturalists, who supposed the shell to be formed from the skin which it covered, as in other shelled Mollusca,—that the inward surface does not at all correspond with the folds of the animal's body within. The spread sail exhibits a silvery surface, with rings surrounding each other, a black spot in the middle, bounded by beautiful gold colour; the neighbourhood of the suckers along the keel and spiral is of a vivid purple. The shell, during life, is by no means brittle, but so flexible as to admit of the two sides being squeezed together without injury, and this pliancy can be recovered even after drying, by simply soaking it in water. We have already said that there is no muscular attachment of the body to the walls of the shell; the animal seems to retain its position by the pressure of the sac against the

ribs, and by the embrace of the sails outside. In order to remove all doubt as to the real ownership of the shell, Madame Power broke the shells of twenty-six in different degrees, and had the satisfaction of seeing that some of them by covering the shell with the sails, and wrinkling them upon the part, closed the fracture. The first day, the new substance was as thin and delicate as cobweb; it thickened and hardened gradually, until in about thirteen days it had become perfectly shelly as the unwounded part, but more opaque. It is remarkable that if the wounded Poulpe can find a fragment of broken shell lying about, it takes hold of it and applies it with the sail to the breach, so that it shall help to fill up the aperture, and it becomes cemented in as part of the renewed matter. If the shell, however, be destroyed, the animal cannot construct a new one, but dies.

The Argonaut is found in the vicinity of Messina, and even in the port, all the year, but is most abundant in autumn, and in the muddy parts of the port, where the boats lie thickest. When on the surface, if they observe any person, they fold the sail-arms over the shell, dispose the rowing arms within it, and sink.* If they happen to be beneath when alarmed, they eject their ink, to gain time to hide themselves in the mud. Those in the cages, after the ink-bag was emptied, would, if still pursued, spirt water from the funnel, then shrink within the shell, covered with the sails. When calm and quiet,

* See fig. 3, p. 217.

and unconscious of being observed, they would exhibit their many beauties rowing along, their full sails tinged with elegant colours, resting the extremities of the sails on the two sides of the shell, or embracing the shell with them. When pressed by hunger, they would come almost to the surface, and when Madame Power offered them food, they would snatch it out of her hands and greedily devour it. The eggs are like millet-seeds, perfectly transparent, attached by filaments of brilliant gluten to a common stem of the same. Three days after the eggs had been discovered, the little Poulpes were observed, in the shell of the parent, without any shell, like small worms. Soon after, they began to shew buds with two rows of points on them, the rudiments of the arms and suckers; the sail-arms appeared first by several days. On the sixth day, the first vestige of a shell was seen, very thin and flexible. The eggs are found in the interior of the spire of the parent, the young between the roof of the spire and the mantle; the infant shell seems to be first deposited in the end of its parent's spire, whose form it thus assumes; but, after a while, it carries on the process without aid. Two or three eggs are developed at a time; when the young are about three-quarters of an inch in length, they inclose themselves in the spire of the parent, where they remain four days to acquire the shell; three days more they remain under the body of the old one, and are then ejected.*

* See Mag. of Nat. Hist. April 1839.

M. Sander Rang, who enjoyed ample facilities for observing these animals at Algiers, does not countenance the notion of their sailing and rowing, though his opinion can hardly counterbalance the positive assertions of Madame Power. His remarks on their motions are interesting. "Watching," says he, "what took place around the Poulpe, which we left contracted within the Argonaut shell, we saw it extending itself from its shell, and protruding six of its arms; then it threw itself into violent motion, and travelled over the basin in all directions, often dashing itself against the sides. In these different movements, the body leaned a little towards the fore part of the shell, and the long slender arms, much extended, and collected into a close bundle, were carried before it as well as the tube, which shewed itself open and protruded. The locomotion was effected in the ordinary manner of Poules, backwards, by contraction of the sac, and expulsion of water through the funnel.* The disposition of the animal and shell is the most favourable for aiding the motion of the creature. The lightness of the shell; its narrow and keeled form; its width, smallest at the part which cleaves the water; the membrane smoothing all inequalities of the shell; the bundle of arms extending behind, so as to offer the least possible resistance; the two arms, stretched like a bridge over the cavity where the eggs are, as if to throw off the water from that cavity; all these adaptations concur to facilitate the gliding of the

* See fig. 1, p. 217.

animal through the medium in which it is to move." By-and-by, as if tired with its exertions, it sunk ; and after a while, fixing its suckers on the bottom, it began to rear up its shell and crawl on its head,* (somewhat in the manner of a snail,) the arms turned upwards, and the sails spread over the shell.†

Nautilus,‡ the Pearly Nautilus.

Somewhat resembling the preceding in general form, the genus before us inhabits a large and strong shell, with a smooth rounded outline, somewhat flattened at the sides, with a very wide mouth, and with the back part rolled into a spiral within the cavity. Its great peculiarity is, that it is divided within into a great number of separate chambers with shelly walls, in the outermost of which, of course, the animal resides. A slender tube runs through the centre of all the chambers, quite to the end of the spire. The membranous end of this tube is continued into the body of the living animal, which is supposed to have the power of admitting water into it or ejecting it, and thus making itself either heavier or lighter than the surrounding medium. The inhabitant of this remarkable shell differs in many important points from other *Cephalopoda*. Its gills or lungs are four instead of two; it has but a single heart; the head is furnished with

* See fig. 2, p. 217.

† Mag. Nat. Hist., N.S., vol. iii. p 521.

‡ Ναυτίλος, *nautilus*, a sailor ; its Greek name.

a strong leathery hood, into which it can be completely drawn, and which then acts as an *operculum*.* In place of the eight long arms, there are forty short ones, destitute of suckers, but more or less rough, capable of being protruded or retracted; while the mouth is surrounded by a series of tentacles, yet more numerous. The best known species (*N. Pom-pilius*) is common in the Indian seas, whence its shell is brought to our collections in great numbers. Until very lately, however, no modern naturalist had seen the living animal; but George Bennett, Esq., had the good fortune to obtain a specimen near Erromanga, an island which has since acquired a notoriety, as the scene of the massacre of the late lamented Mr. Williams. The Nautilus "was found in Mare Kini Bay, floating on the surface of the water not far distant from the ship, and resembling, as the sailors expressed it, a dead tortoiseshell cat in the water. It was captured, but not before the upper part of the shell had been broken by the boat-hook in the eagerness to take it, as the animal was sinking when caught."† The colour of the shell is whitish, with bands of bright fawn colour, and within of the richest pearly hue.

Many fossil shells are discovered having a chambered structure, called *Belemnites*, *Ammonites*, *Nummulites*, &c., whose animals probably belonged to this class. Some of them were of vast size, the shells being as large as a coach-wheel.

* The horny plate which defends the mouth of spiral shells.

† Mr. Bennett's Journal.

CLASS II.—PTEROPODA.*

THIS Class contains a very few animals of small size, that swim in the ocean, but, having no feet, are unable to fix themselves to any object. Their organs of motion consist of a large broad wing-like expansion, placed on each side of the head. They have no shell; but enliven the surface with their appearance in fine weather, where in immense hosts they float about, dancing merrily along and directing their course by means of their fleshy head-fins.

Clio.†

Minute as are the creatures now under our notice, they perform no useless or inconsiderable part in creation, for, from their vast numbers, they make the surface of the dreary Arctic sea alive with their gambolings, while they supply a large portion of the subsistence of the great northern Whales, whose mighty jaws engulph thousands at a time. The present genus is the only one we can pause to describe in this Class, and the species we select is the best known, the Arctic *Clio* (*C. Borealis*). It is about an inch in length, oblong, without shell or mantle; the two pretty wing-like fins by which it moves are, it seems, but a single organ, being connected by

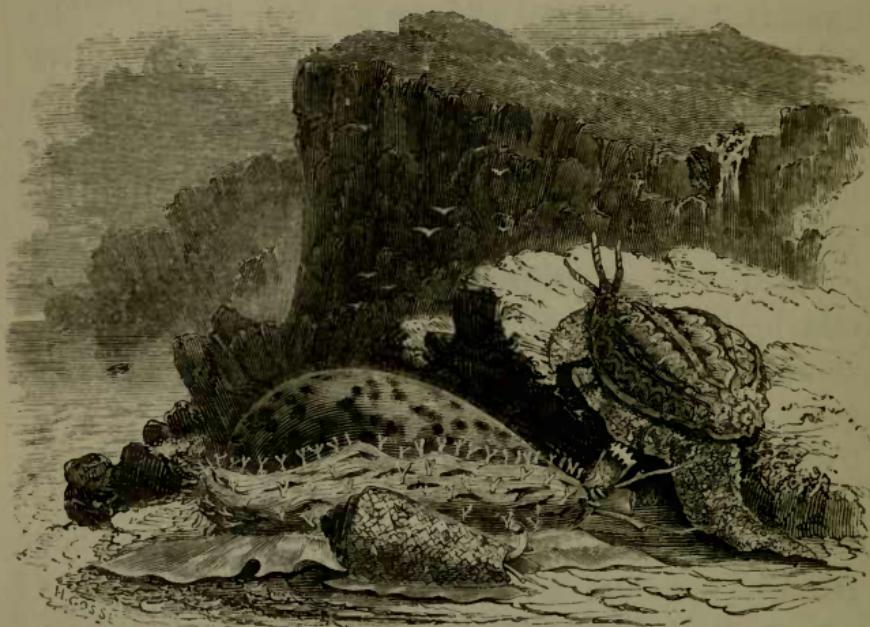
* Πτερόν, *pteron*, a wing, and πούς, *pous*, a foot.

† The name of one of the Muses.

a part concealed from view, and passing right through the neck, and expanded on each side ; "forming an apparatus exactly comparable to the double-paddled oar with which the Greenlander steers his kajac, or canoe, through the very seas inhabited by the little Clio we are describing." The head exhibits a most astonishing display of creative design ; around the mouth are six tentacles, each covered with about three thousand red specks, which are seen by the microscope to be transparent cylinders, each containing about twenty little suckers, capable of being protruded, and adapted for seizing and holding their minute prey. "Thus, therefore, there will be three hundred and sixty thousand of these microscopic suckers upon the head of one Clio ; an apparatus for prehension perhaps unequalled in the creation."* The jaws and tongue are found to be of equally elaborate construction, and the whole mouth is covered, when not in use, by a sort of double hood, which closes over it like a case.

* Jones, Anim. Kingd. p. 425.

CLASS III.—GASTEROPODA.*



TIGER COWRY (*Cypraea Tigris*), HARP (*Harpa Ventricosa*), and
CLOTH-OF-GOLD CONE (*Conus Textilis*).

THE animals which compose this Class are numerous and widely spread, inhabiting the earth, the fresh waters, and the ocean, and in many of their forms are familiar and well known. Although they differ widely among themselves in appearance, and even in structure, there is much that is common to all, and they are consequently a very natural and

* Γαστὴρ, gaster, the belly, and πούς, pouς, a foot.

well-defined group. Their principal distinction is, that they crawl with an uniform gliding motion upon a fleshy disk, situated beneath the body. The back is furnished with a thick fleshy mantle, generally projecting, very diverse in shape, but in most cases producing a shell; the shell, however, is not always visible. A distinct head is placed in the front of the body, sometimes partly concealed by the mantle, furnished with fleshy tentacles, above the mouth but not surrounding it. In some of the most familiar species, the eyes are placed on two of these projections, but in others they are wanting; but all the senses seem very obtuse except that of touch, which is extremely delicate. When a shell exists, it is formed in the thickness of the mantle, enveloped in its substance, or on its surface exposed to the air; its use is to protect the animal from external injury, being in general large enough to receive and conceal the whole body; and in those cases where it is internal and very small, it is still so placed as to protect the most important organs, the heart and lungs. It is more or less hard and brittle in its texture, acquiring in some of the great marine shells, the Conchs (*Strombus*) for example, a stony strength and hardness. In a few species it is regular and symmetrical in shape, but in very many it is twisted in a spiral direction around a centre, which is sometimes hollow. The aperture formed by the edges of the shell can, in most cases, be accurately closed when the animal has drawn itself within, by means of a shelly or horny plate (*oper-*

colum) attached to the foot. The common Slugs of our gardens and fields will illustrate the naked Gasteropods; while the Limpet, the Snail, the Periwinkle, the Whelk, and the Conch, will exemplify those protected by a visible shell.

The Class has been divided into eight or nine Orders, distinguished chiefly by the form and position of the lungs; into these, however, we cannot enter with minuteness, but must confine ourselves to a brief notice of a few of the most remarkable and interesting species. Of these we cannot select a genus more universally known, at least in our own climate, than that of

Limax, the Slug.*

It is distinguished by a lengthened body, covered only in part by the mantle, which is confined to the fore part of the back over the lungs; it contains in general a small, flat, transparent oval shell, which is found only on cutting open the mantle. The lungs communicate with the air by an opening on the right side of the mantle, which may be readily seen in the living animal, expanding and closing. The head is furnished with four tentacles, or fleshy feelers, in which an exquisite sense of touch is placed; they can be withdrawn completely into the body at will, or protruded by turning inside out, as we pull off a stocking. The upper pair are the longest, and terminate in little knobs, in each of

* Its ancient Latin name.

which is seen a minute black speck, now ascertained to be an eye, of considerable perfection of structure. The mouth is singularly formed, having only an upper jaw, resembling a curved blade with a sharp toothed edge, against which the soft parts of vegetables are pressed by the fleshy lips and easily divided. The common Grey Slug of our gardens (*L. Agrestis*) is one of the most destructive of animals, and is peculiarly injurious, because its appetite is most voracious just at the season when the young plants are beginning to put forth their first tender leaves, and can ill sustain the merciless attacks of this depredator. We know no better way of eradicating this pest from a garden than by carefully searching for them individually after a shower or an artificial watering, immersing them in a little salt and water, which kills them instantly. We have thus destroyed from one to three hundred each evening for many days in succession, in a very small piece of garden-ground. They may be prevented from approaching any individual plant, by strewing around it dry earth, dust, ashes, soot, &c., as on such light and dry substances they cannot crawl; it must be renewed, however, of course, if it happen to become wetted, the efficacy consisting wholly in the dryness of the surface.

Very different from the Slug in outward appearance, but closely resembling it in structure and habits, is the genus *Helix*, the Snail.

Helix, the Snail.*

The shell is large, and usually somewhat globular; the last whorl but one, encroaching upon the circular form of the aperture or mouth, renders the latter somewhat crescent-shaped. The Garden Snail (*H. Hortensis*) is our most common native species; but though large, it is far exceeded by the Esculent Snail, (*H. Pomatia*,†) which is said to have been introduced from the continent into our southern counties, where it now abounds. The history and economy of this large and fine species having been more studied than those of the others, we shall speak chiefly of it, but the rest probably differ but little from it.

From twenty-five to eighty eggs are laid by the Esculent Snail in a hole in the earth, which it then carefully closes. This usually takes place in June; they are round, hard, and white, as large as small peas, and resembling mistletoe-berries. Exposed to the damp of the earth, they need no care to hatch them; but in the course of three or four weeks, according to the heat of the weather, each produces a little Snail. It gnaws a passage for itself through the egg with its singular tooth, and comes forth with its tender shell, consisting of a whorl and a half. For a while it feeds, like the caterpillars of some insects, on the egg-shell which it has just forsaken. When this is devoured, it eats the soil which surrounds it, mixed as it is with decayed vegetable

* Ἔλιξ, *helix*, spiral.

† Πόμα, *poma*, an operculum.

matter. A month elapses before it ventures from the hole in which it was born, into the air and light of this upper world, when at length it begins to devour living vegetables, though still for some time preferring such parts as are in a decaying state. Through the remainder of the summer it increases rapidly in size, but the frosts of October check its activity, and warn it to prepare a winter lodging. It now becomes dull, ceases to feed, and associates with others of its kind in considerable numbers, in ditches, hedges, holes, &c. Its mode of forming its winter concealment is very curious: having selected the place, it begins by secreting on the under surface of the foot a quantity of very thick slime; it presses its foot to the earth, a layer of which adheres to it; then turning its foot up on one side, and throwing out a fresh supply of slime, the layer is left like a little wall. The Snail then takes up another layer of earth in the same manner, and forms another portion of the wall, thickening them in course, and deepening the cavity in proportion as he enlarges the walls. The mucous slime with which the earth is stuck together and lined, renders the walls of this habitation strong, durable, and smooth. Having raised the walls, the little architect proceeds to construct a dome or arched roof of the same materials, the foot with the successive layers of earth being applied to the upper part until the walls meet in an arch. If a portion of this be now very carefully removed, we may see what follows. The Snail is lying with the mouth of the shell facing the roof

in a perfectly horizontal position ; the foot is contracted within the shell ; the thick edge or collar of the mantle is expanded over it, and is very white and plump. In about an hour after the finishing of the roof, the breathing-hole in the right side is opened, and a quantity of air is inspired ; then, closing the orifice, it forms a very thin and transparent layer of slime, like a skin, between the surface of the mantle and the substances outside. Presently, from the whole surface of the collar, is poured out a copious fluid like thick cream, of a pure white, which, covering the whole of the exposed part of the animal, hardens immediately, and in the course of an hour is become a perfectly solid operculum, a little thicker than a wafer. The Snail now expels a portion of the air it had taken in, and thus contracting, retires farther into the shell, leaving a chamber of air between it and the *operculum*. Here it forms another layer of slime, which hardening into a skin stretched across the shell, it expels more air and retires farther, thus leaving another chamber, and so on until sometimes even six of these partitions are formed, inclosing cells filled with air. Two or three days are occupied by a single Snail in these operations ; but the whole of October is spent before all have finished, and by the beginning of November none are found abroad except such as from disease have not sufficient strength to form their retreat, and which perish with the first severe frost.

In this snug habitation the Snail sleeps away six months of the year, all unconscious of the wintry

storms that are howling over its head, without sensation, circulation, respiration, or any of the ordinary functions of life. When the twittering Swallows arrive from their long migrations, and the voice of the Cuckoo begins to be heard in the leafing woods, the buried Snail feels the reviving influence of spring, and heaves up his head. The manner in which its escape is effected is simple, and easily comprehended. The air which is contained in the cells is again inspired by the animal, and the membranous partitions burst one by one, by the projection of the foot through the mantle. When it arrives at the thick and strong operculum, the Snail, making a last effort, bursts and detaches its most obtuse angle. Then, insinuating by degrees the edge of the foot between it and the shell, it at length forces it off, bursts its habitation, and crawls forth to satiate its returning appetite with the leaves and flowers of spring.

It appears that moisture as well as warmth is necessary to the activity of Snails; and that, during the heat of summer, they retire within their shells, closing the aperture with a membrane of dried slime. In this state they remain night and day while the weather continues dry; but on the occurrence of a shower they again crawl about, which they may also be induced to do by watering the ground around them.

We have seen that it is the edge or collar of the mantle which secretes the shelly operculum; it is the same organ which ordinarily forms and en-

larges the shell by successive additions to its outer edge. It is also by the same medium that accidental injuries to the shelly covering are repaired. Mr. Bell observes, "I have at different times cracked the shell, removed small portions, and drilled holes through it at different parts; and I have found that if the injury were within the reach of the edge of the mantle, it was always drawn up to repair it. I drilled a hole in the shell of *Helix Pomatia* in the last whorl but one, thinking that it could not draw the edge of the mantle high enough to repair it in the usual way; however, it effected this immediately by protruding the foot to make room for the mantle being drawn high up into the shell, and as soon as the edge came in contact with the injured part, it was passed repeatedly over the hole, leaving a layer of calcareous matter each time until it became opaque; and in a day or two, on examining it, I found the newly-formed part apparently as strong as the rest of the shell."*

Ianthina,† *the Violet Snail.*

Though belonging to a different order, the shell of this Gasteropod much resembles that of the Snail; the animal, however, which is marine, differs materially. It has no *operculum*, but the under surface of its foot is furnished with what appears to be a mass of foam-bubbles, but composed of a solid sub-

* Zool. Jour. vol. i. p. 93.

+ Ἰάνθινος, *ianthinos*, purple.

stance, which, while it prevents it from crawling, gives it the faculty of swimming at the surface of the water. "When the sea is calm, these animals may be seen collected often in large bands, swimming over the surface, by means of this floating apparatus of bubbles, aided by a fin on each side of the body. During this action, the head is very prominent, and the foot is so extended, that the float, or line of vesicles, forms an angle with the middle of the shell. When the sea is rough, the animal absorbs the air from its vesicles, changes the direction of its foot, contracts its body, and lets itself sink. It does the same when in danger from any enemy, and further, like the Cuttle-fish and some others, colours the water by the emission of a blue fluid, which serves to conceal it. They are vividly phosphoric in the night. Birds carry them off with great dexterity.

"If their floating apparatus is mutilated, the foot can reproduce it. The violet coloured shell of this little animal is remarkably thin, which facilitates its excursions on the surface. It is singular, that under its fragile float, a little line of pearly fibres may be perceived, to which are attached its eggs; in some species they are contained in little membranous bags, or sacs. It is thought that the young animals, when liberated from these bags, or chambers, ascend their mother's float, and so are transported to the surface. Fishes are enabled to rise to the surface of the water, by means of their air-bladders, and some *Radiaries* by a vesicle which

surmounts them, but neither of these are more singular than these outriggers, by which the vessel of the Violet Snail is kept both buoyant and steady."*

We are not aware whether the violet coloured fluid discharged by this species, is capable of application to the arts, but from several species of the great genus

Murex,† the Rock Shell,

a liquor is obtained, which, before the discovery of cochineal and other modern dyes, was held in high estimation. One species of this tribe produced the far-famed Tyrian purple, the brilliancy and permanence of whose hue are so highly celebrated by the ancients. The genus is marked by the long straight canal which terminates the mouth of their shells, and the formidable array of ridges and spines with which they are armed. The animal is furnished with a proboscis, and long tentacles, on the outer side of which are placed the eyes; in many respects, it resembles the common Whelk, (*Buccinum*,)‡ but has no operculum. The reservoir of its purple dye is placed above the neck, by the side of the stomach; it seems probable that it is intended as a protection for the creature, being squirted out when alarmed, in the manner of the *Cephalopoda*. The process by which the ancients transferred the hue to silken, linen or woollen stuffs, has long been lost; Aristotle, how-

* Kirby, Bridgewater Treatise, vol. i. p. 291.

† Its ancient Latin name. ‡ *Buxávn, bukane*, a trumpet.

ever, informs us that it was considered necessary to extract the dye as soon as the animal was captured, as it was discharged if allowed to remain untouched. The smaller shells were crushed, but from the large ones the animal was extracted. They are said to bury themselves in the wet sand of the shore.

The spinous projections, often of great length and slenderness, with which many shells are armed, may possibly be intended for a defence against violence, but the species which are most remarkable for them are themselves of carnivorous propensities. That these, however, do not always preserve them, we have already seen, for even the thick and stony processes of the gigantic Conchs of the West Indies (*Strombus*)* are crushed in the jaws of the Logger-head Turtle.

As the outer surfaces of shells are often marked with bands and spots of various colours, while the inside shews an uniform pearly tint, it may not be uninteresting to say a word on the mode in which these respective hues are produced. In shelled *Gasteropoda*, the mantle generally covers the whole of the parts usually contained within the shell ; its outer edge is thickened into a glandular collar, which is the source from whence the shell's increase in size is derived. The mantle is studded with glands that secrete the colouring matter of the various hues and patterns that mark the shell. When the animal wishes to enlarge its dwelling, this thick collar is

* The ancient Greek name of some spiral shell, from *στρέοβιειν*, strobeo, to twist.

firmly fastened all round the edge of the shell; stony matter is now secreted and deposited by it layer upon layer, and wherever the coloured glands are placed there is a corresponding patch of colour. Thus is the edge of the shell enlarged, and each successive layer is thus painted at the moment of its formation. The increase of the shell in thickness is a subsequent process: the whole surface of the mantle, except the collar, deposits a layer of pearly matter upon the whole interior of the shell, including the new part recently formed at the edge: and as this portion of the mantle is destitute of colouring glands, so the glassy surface of the interior shell is nearly deprived of colour, except the opaline reflections which play over it in the changing light. The projections of the ridged and spinous shells appear, in like manner, to be formed by answering furrows and depressions in the margin of the mantle.*

In the genus, whose numerous and beautiful species are so common in our cabinets,

Cypraea,† the Cowry,

The mantle is remarkably ample, expanded into two large wings, which fold over and envelop the shell; at certain periods of its age, a fresh layer is thus deposited over the outer surface, varying in colour from the preceding, and the long aperture becomes wrinkled on each side in the adult, which

* See Jones's Anim. Kingd. p. 420.

† From Κύπρης, *kypris*, a name of Venus; on account of their beauty.

before was plain. The outer surface of these shells presents in consequence a high polish resembling that of china-ware; and the whole appearance is so altered, that the young Cowry, which presented the common form of an oblong-oval, turbinated shell, would never be recognised in its mature figure and texture. They chiefly inhabit the tropical seas, and one little species, perhaps the most common of all, the Blackamoor's tooth (*C. Moneta*), is extensively used as money in Africa and the Oriental Archipelago.

In other genera, the adult figure sometimes differs greatly from that of its early stages, as in some of the *Strombi*; in *Pterocera** *Scorpio*, the edge of the mouth, which before was small and entire, enlarges into a broad expansion, extending even all up the spire, and shoots out many finger-like projections, which at first are hollow, but gradually become solid by the deposition of stony matter in their interior.

Patella,† the *Limpet*.

A few genera, of which the one before us affords a good example, vary from the preceding in the structure of their shell, which does not ordinarily assume a spiral form; but resembles an oval, somewhat conical cup, inverted, in the concavity of which dwells the animal, in no very material point differing from the forms we have noticed. In some species,

* Πτερόν, *pteron*, a wing, and κέρας, *keras*, a horn.

† *Patella*, a little dish.

however, there may be detected a tendency to the spiral form at the apex of the cone. The broad foot adheres so firmly to the rocks on which they are found, that it is very difficult to remove without destroying them; while in some localities they occur in such numbers, that the rock seems almost covered by them.

Somewhat allied to these, in general form and appearance, is the genus

Chiton, the Coat of Mail,*

but which shews a remarkable exception to the usual univalve construction of the shells in this Class. Instead of a single shell, we find a shield composed of several plates overlapping each other down the back, and surrounded by the broad uncovered edge of the tough and leathery mantle, in which they are partly imbedded. Like the Limpets, they attach themselves to rocks, often above low-water mark, so that they are left dry at intervals, and not unfrequently they are found adhering to the bottoms of ships, returned from tropical voyages.

"When we consider," says Mr. Kirby, "that these animals are not only often exposed to the violent action of the waves, but also to the attack of countless enemies, we see abundant reason for the coat of mail, with which their Creator has covered them. Even the fleshy or cartilaginous margin or zone, is defended sometimes by scales, spines,

* Χιτών, *chiton*, a coat.

and bristles; at others, rough with numerous little bony tubercles; it is also described as, in general, fringed, so that when the animal attaches itself to a rock or stone, it is altogether calculated by the application of the prone part of its body, to produce a vacuum. These animals are night feeders, remaining stationary during the day; they probably feed on marine plants, the sea-wrack (*Zostera*), &c. They slide along very slowly; if accidentally reversed, they recover a prone position by the violent motions of the ligament or zone that surrounds them, and, if alarmed, they sometimes roll themselves like Wood-lice."*

* Bridgewater Treatise, vol. i. p. 271.



THE WENTLETRAP (*Scallopia Pretiosa*).

CLASS IV.—ACEPHALA.*

ON comparing a bivalve with an univalve Mollusk, we cannot but at once perceive the inferiority of the former in the scale of existence, particularly in the limited character of its motion from place to place, and in the defect of those organs of sense which are possessed by the latter. Indeed, one of the most familiar bivalves, the common Oyster, has become a proverb of insensate apathy, as if it were the lowest form of animal life. Encased within heavy stony plates, so formed as to shut out almost all perception of what is going on without, acute sensibilities or highly developed organs would have been thrown away on them. “Numerous species are, from the period of their birth, firmly fixed to the rock which gives them support, by a calcareous exudation that cements their shells to its surface, as exemplified in the case of the common Oyster; or else, as the Mussels, anchor themselves securely and immovably, by unyielding cables of their own construction. The Scallop, unattached, but scarcely better adapted for changing its position, rudely flaps together the valves of its expanded shell, and thus, by repeated jerks, succeeds in effecting a backward movement; while the Cockles, destined to burrow

* *A*, without, and *κεφαλή*, *kephale*, the head

in the sand, are furnished with a tongue-like foot, by which they dig the holes wherein they lie concealed, and crawl, or even leap about, upon the shore. Many, as the *Pholades*, penetrate the solid rocks and stones, and excavate therein the caverns that they inhabit; or, in the case of the *Teredo*, with dangerous industry bore into the bottoms of ships, or submerged wood of any description, and silently destroy by their insidious ravages, the piers or dykes which human labour has erected."*

This Class of Mollusca is destitute of a distinct head, the mouth being opened in the body within the folds of the double mantle, which enclose the animal, as the covers of a book do the leaves. Enclosing the two folds of the mantle are found, almost universally, two valves of a shell, united at one part of their edge by an elastic hinge. Cuvier, it is true, has placed in this Class certain genera which are merely enveloped in a sort of cartilaginous or leathery bag, open at each end; these agree somewhat in their general structure with the inhabitants of Bivalves; but there is sufficient discrepancy to have induced other naturalists to consider them as forming a very distinct group. The whole Class is essentially aquatic in habits.

The best method of understanding the structure of these animals will be to take a common species, and carefully observe what we see there. There is none more suitable for such an examination than the Scallop.

* Jones, Anim. Kingd. p. 375.

Pecten,† the Scallop.

On opening the shell, we see inside each valve, first, a thin and semitransparent membrane, united to each other, near the hinge. This is the mantle. Its edges are thickened, and surrounded with a delicate fringe of very sensible fleshy filaments: they are studded with glands, which in many cases secrete colouring matter agreeing with the tints on the shell: the shell being enlarged by these glandular fringes, much in the same way as we have described in the Murex. Between the two leaves of the mantle are placed the lungs or gills, four in number, composed of fibres pointing outwards, of exquisite structure, free at their outer edges, so as to float loosely in the water. The mouth is placed between the two inmost gills, where they unite; it is a simple orifice, without anything answering to teeth, but having four thin membranous lips on each side the aperture. Near the mantle is placed a fleshy organ, somewhat resembling a finger, capable of enlargement and contraction, called the foot, which, though small in the Scallop, becomes, in some genera, of large dimensions, and assumes functions most important and interesting.

Two circumstances here are likely to strike an attentive inquirer, and to awaken his curiosity. Confined as the animal is, to an almost motionless shell, how is it provided with that constant succession of fresh and unrespired water to the gills,

* *Pecten*, a comb.

without which, suffocation and death would infallibly ensue? Secondly, how is the food conveyed to the mouth? for fixed as it is, and unfurnished with any seizing organs, and unable to protrude any part of its body beyond its stony abode, it is not easy to imagine by what means a due supply of nutriment is provided.

"Wonderful indeed is the elaborate mechanism employed to effect the double purpose of renewing the respired fluid, and feeding the helpless inhabitant of these shells. Every filament of the gill-fringe, examined under a powerful microscope, is found to be covered with countless *cilia*,* in constant vibration, causing, by their united efforts, powerful and rapid currents, which sweeping over the entire surface of the gills, hurry towards the mouth whatever floating animalcules or nutritious particles may be brought within the limits of their action, and thus bring streams of nutritive atoms to the very aperture through which they are conveyed to the stomach, the lips and labial fringes acting as sentinels, to admit or refuse entrance, as the matter supplied be of a wholesome or pernicious character. So energetic, indeed, is the ciliary movement over the entire extent of the gills, that if any portion of them be cut off with a pair of scissors, it immediately swims away, and continues to row itself in a given direction as long as the cilia upon its surface continue their

* *Cilia* are organs of motion extensively found in the lower classes, consisting of exceedingly minute hairs, endowed with the power of rapid and regular motion.

mysterious movements."* Thus does God care for the meanest of His creatures : thus is "His tender mercy over all His works!"

The mode by which Bivalve shells are closed and opened is curious. They are connected, in the hinder part, by a hinge, formed differently in different genera. The most simple is that of

Ostrea,† *the Oyster.*

A perpendicular mass of highly elastic fibres is interposed between the two hinder edges, so disposed, that when the shells are forcibly pressed together, it is squeezed into a very short compass, but powerfully expands immediately the force upon the valves is removed, and forces them open to a greater or less extent. This is the apparatus for opening the shells.

The closing of them by overcoming the expansive force of the hinge-ligament, is provided for in a strong elastic muscle, which passes perpendicularly across from the middle of one shell to the opposite. The fibres of this muscle contracting with immense force, resist the opening ligament, and that so powerfully, as is well known to every eater of Oysters, that the most violent efforts to open the shells are vain until the breaking away of the edges affords an aperture for the knife, to separate the contracting fibres.

In speaking of the *Gasteropoda*, we have endeavoured to describe the mode in which the growth

* Jones, Anim. Kingd. p. 378.

† Its Latin name.

of shells takes place: that description is applicable to the Bivalves; the fringed edges of the mantle secreting the stony matter in the form of a viscid cement, and depositing it around the shell by being projected and turned back over its margin, while the colouring glands supply the various tints; and on the other hand the whole general surface of the mantle depositing a layer on the inside of the shell destitute of colour, and forming the beautiful substance called *nacre*, or *mother of pearl*. Wounds or irritation in any part of the mantle cause an increased secretion of pearly matter in that part, and hence the origin of those highly esteemed, and beautiful productions, called *pearls*. Minute boring worms often perforate the shell of the Pearl-bearing Bivalves among others, and even penetrate to their bodies. The mantle thus irritated, throws out pearly matter in great abundance on the wounded spot, which increasing, layer by layer, soon forms a globular excrescence, a pearl of greater or less size and purity. Sometimes, moreover, a minute atom of sand, or fragment of stone, may become introduced between the mantle and the shell. In this case the secretion is copiously poured out, coating over the little annoyance until a detached pearl is formed, the more valuable, because perfect in its whole circumference. A slight account of the mode in which these costly articles are obtained, may not be unacceptable or out of place, though the animal producing them in most abundance seems to be not a true Oyster, as commonly supposed, but a species

of *Mytilus*. Our information is abridged from a recent work,* by the Count de Noé, a French officer in the British service formerly stationed at Ceylon.

"The pearl Oysters lie in banks at greater or less depths in the sea. These banks occur on the western side of the island of Ceylon, about fifteen miles from the shore, where their average depth is about twelve fathoms. The fishery always commences in April; because the sea is at that time in its calmest state, and continues to the end of May. Not only are multitudes of natives attracted to the coast, but crowds of speculators from all parts of India, whose various language, manners, and dress, are very striking and pleasing. The temporary abodes erected for them are also curious and picturesque. On the solitary shore, a collection of almost innumerable huts is at once seen to arise on the eve of the fishery. These huts are merely a few poles stuck in the ground, interwoven with light bamboos, and covered with cocoa-nut leaves, yet these slight habitations often shelter one hundred and fifty thousand persons.

"The signal for beginning the fishery is given at daybreak, by the discharge of a cannon, on which a countless fleet of boats, that have started from the shore at midnight, and favoured by a land breeze, have reached the banks before dawn, cast anchor on certain prescribed parts of the banks, and proceed to work. Government vessels are on the spot, to prevent any boat from fishing beyond its proper limits.

* Mémoires relatifs à l'Expédition Anglais, &c.

The boats of the fishers generally carry a captain, a pilot, and twenty men, ten of whom are experienced divers. The ten divers are divided into two companies of five each, and these companies plunge and relieve each other by turns.

"That they may descend through the water with greater rapidity to the bank round which the oysters are clustered, the divers place their feet on a stone attached to the end of a rope, the other end of which is made fast to the boat. They carry with them another rope, the extremity of which is held by two men in the boat, whilst to the lower part, that descends with the diver, there is fastened a net or basket. Besides these, every diver is furnished with a strong knife to detach the oysters, or serve as a defensive weapon in case he should be attacked by a Shark. As soon as they touch ground they gather the oysters with all possible speed, and having filled their net or basket, they quit their hold of the rope with the stone, pull that which is held by the sailors in the boat, and rapidly ascend to the surface of the sea.

"The marvellous stories that are told, of the length of time that these divers can remain under water have no foundation in truth. All the evidence that can be depended upon establishes the fact, that the most skilful cannot exceed and rarely endure the submersion of a minute.

"Alternately plunging and reposing, the divers continue their occupation until about ten o'clock in the forenoon, when the sea breeze begins to blow,

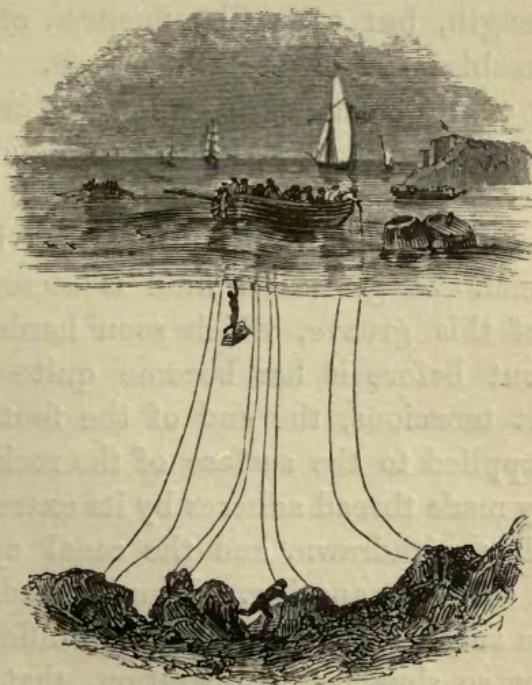
and one of the government vessels fires a gun, as a signal for the whole flotilla to return to shore. As soon as the boats reach the beach, an immense number of labourers, men, women, and children, rush to them, and carry off the produce of the day's fishing. Every speculator has his own group of huts, and in the midst of each of these is a *couttô*, or space of ground enclosed with poles and transverse pieces of bamboo, but open to the air. In these *couttôs* are deposited the oysters, as they are landed, and there they are left to putrefy, which they soon do under a burning sun. It is a curious fact, that though these numerous *couttôs*, each containing an enormous mass of oysters, all putrefy together on a narrow extent of soil, and emit the most detestable odours, yet the health of the precarious but crowded population gathered there is no way affected.

"As soon as the putrefaction is sufficiently advanced, the oysters are taken from the *couttô*, and placed in troughs; sea-water is then thrown over them. In their putrid state, the oysters easily yield the pearls they contain, and a number of men, all standing on the same side of the trough, rapidly shake them out and wash them. After all the shells are thrown out, the pearls remain on the sand at the bottom of the trough. * * *

"During the prosecution of this fishery, few places can be more animated than the western point of Ceylon. The oysters, or the cleansed pearls, are bought or sold on the spot, and besides this trade,

the confluence of so many crowds from different countries attracts dealers in all sorts of merchandise. The long line of huts is a continuous bazaar, and all is life and activity. But, the fishery over, both natives and strangers depart, the huts are knocked down, scarcely a human habitation can be seen for miles, and the most dreary solitude prevails until the next year."

The Oyster is usually affixed to the rock on which it was born, by the under valve of its shell, the surface of which is, as it were, firmly cemented to the rock, so as to prevent any possibility of motion. Other Bivalves are attached in an equally effective,



THE PEARL-FISHERY.

but very different manner, being moored like a ship with one or more cables of strong silky threads, called *byssus*. The common Mussel (*Mytilus Edulis*) is a familiar example; but, more celebrated for this structure is the genus

Pinna, the Wing-shell,*

in shape like a Mussel, but more triangular; though large, being sometimes three feet in length, it is frail, being semi-transparent and very thin. In order to secure it from those buffettings of the storm, which might soon dash its brittle habitation to pieces, the Pinna forms a series of threads of great strength, but of a silky fineness, of which in Italy, valuable stuffs have been woven. These are not spun out to an indefinite length, as in the Silk-worm and Spider, but are formed in a mould. The foot, which is small, has a groove through its length, which by the closing of its edges may be formed into a canal. A glutinous fluid is secreted in the bottom of this groove, which soon hardens into a thread, but before it has become quite hard, and while yet tenacious, the end of the foot is thrust out and applied to the surface of the rock, to which the newly made thread adheres by its extremity; the foot is then withdrawn, and the canal opened and prepared to make another. Many threads are thus formed in succession, and stretched in different directions, but so slow is the operation, that not more

* *Pinna*, a fin.

than four or five can be completed in a day and night. Every thread is tested as soon as made, by the swinging of the shell as far as those already fastened will allow, by which perhaps the thread may be slightly stretched. According to Reaumur, the animal exercises this instinct, even from its earliest infancy, for he saw some of them forming threads, when the whole shell was not larger than a millet seed.

Another genus which forms a cable of *byssus*, and which is interesting in other respects, is

Tridacne, the Clamp,*

marked by the three openings with which the mantle is perforated, one for the passing out of the foot, the second for respiration, and the third for the evacuations. The animal is remarkable for not being placed in the shell, but, as it were, partly thrust out in front. Some species attain a vast size, as the enormous Clamp of the Indian seas, (*T. Gigas*), whose shells alone sometimes weigh three hundred pounds, and measure four feet in width. It is marked with high and broad ribs, relieved by projecting scales. Its vast weight is sustained by a strong cable of *byssus*, which passes through an opening below the hinge, and by which it is suspended to the rocks, however heavy, and securely fixed out of the reach of storms. So tough and

* Τρεις, treis, three, and δάκνω, dakno, to bite, as if bitten in three places.



THE SPOTTED HORSE-FOOT (*Tridacna Maculata*).

strong are the tendons of its cable, that they can be severed only by repeated strokes of an axe. The flesh, though tough, is eatable, and a single one is said to be a plentiful meal for a hundred and fifty men.

Many of the Bivalves have, however, a more extended sphere of action, possessing the power of changing their place, though in general but slowly. But in the genus

Cardium, the Cockle,*

more agility is manifested, than we should at first

* Καρδία, *kardia*, a heart.

sight suppose it possible that such a creature could exercise. The changeable organ, the foot, which, (absent in the Oyster, and but slightly developed in the Scallop,) we have seen to be the mould which forms the cable in the Pinna, now assumes the function more in conformity with its name, and becomes the organ of locomotion. In the genus before us, it is developed to a great size; in structure it much resembles the human tongue, as well as in its power of assuming various shapes. It is used for burrowing in the sand, for which it is admirably adapted. The animal lengthens the foot, and thrusts it deep into the sand, then turning the end into the shape of a hook, and thus acquiring a hold, it forcibly contracts the foot, by which the whole animal is gradually brought into the hole and buried, till only a projecting tube can be seen, through which it breathes.

By an opposite process, bending the end of the foot, and pushing against the sand at the bottom of the hole, the shell is again protruded in a succession of efforts. At the bottom of the water, the Cockle can also move with considerable speed, by pushing with its foot against the ground, as a ferryman poles his boat across a river. Nor is this all. For, by stiffly bending the same wonderful organ in a hook, and pressing it forcibly against the ground, a sudden spring-like extension of the hook throws the Cockle into the air, and, by a repetition of these jerks, it skips along with marvellous agility.

The foot attains a very great size in the genus

Solen, the Razor-shell,*

in which it is used for burrowing in the sand or mud, and perhaps these Bivalves are the most dexterous burrowers of all. The shell is very much lengthened sidewise, the two valves forming, when closed, a long tube. "The Solen excavates for itself a very deep hole in the sand, boring its way, by means of its foot, to a depth of some feet; and remains concealed in this retreat, usually occupying a position within a few inches from the surface. The fisherman, armed with a slender iron rod, furnished with a barbed head, resembling a harpoon, treads carefully backwards over the beach, left bare by the retreating tide, and finds the holes in which the Solen lodges, by watching the little jet of water thrown out by the animal, when, being alarmed by the shaking of the sand, it contracts its body. Guided by the orifice, through which the water is thrown, he plunges his rod into the sand, and generally succeeds in piercing the animal with the barbed extremity, and dragging it from its concealment; but should he fail in his first attempt, he well knows that to try again would be unavailing, for the animal instantly works its way down to such a distance as to render pursuit hopeless."*

Few of this Class are more astonishing in the powers which they possess, than the following genus.

* Σωλὴν, solen, a tube.

† Jones, Anim. Kingd. p. 382.

Pholas, the Stone-borer.

Which is able in some manner, hardly yet understood, to excavate solid rocks into deep holes, in which it dwells. The shell is much lengthened transversely, and the outer surface is roughened by ridges crossing each other like a rasp. It has been said that the animal fixing itself by the foot, which expands at the tip into a sucker-like disk, keeps perpetually turning partly round, to and fro, and thus wears away, or files, the substance of the rock. When we consider, however, the very fragile texture of the shell, and that it is destitute of LIFE, which would resist the "wear and tear" of mechanical action, we cannot help thinking that some fluid is secreted, which aids the process, by dissolving or softening the stone. As the minute fragments abraded would soon fill up the hole and stifle the animal, it is endued with the power of sucking them in, and expelling them through one of its orifices, in a forcible jet of water.

Teredo,† the Shipworm.

This is closely allied to the last genus, in its instincts, but chooses a field for the display of its energies, which renders it formidably obnoxious to man. It attacks timber when permanently beneath the

* Φωλᾶς, *pholas*, living in a cave.

† Τερέδων, *teredon*, a borer.

surface of the sea, boring tubular canals in the direction of the grain of the wood, not for the purpose of feeding on its substance, but merely for the defence of its naked body. The shell is very small, and the mantle protrudes considerably, in the form of a lengthened tube. We have seen a piece of floating timber so perforated, as scarcely to bear being handled ; and the once powerful republic of Holland has repeatedly been threatened with ruin, in the destruction of its dykes by this borer. Ships' bottoms are frequently destroyed in tropical seas from the same cause, and probably the foundering of many a gallant craft, unheard of and unknown, has been the work of the silent and insidious Shipworm. The valves are roughened, and act as an auger. The interior of its cave is always lined with a smooth shelly crust, which is secreted from the mantle, and acts as another shell. Fortunately, both it and the *Pholas* cannot live in fresh-water, or our bridges would have but a very brief existence.

To represent the ACEPHALA TUNICATA,* or those which are invested in a leathery coat, answering to the shells of Bivalves, we select the genus

Pyrosoma,†

one of the second family of this division, consisting of small animals, habitually united in a com-

* Considered by some naturalists as a distinct Class, and named TUNICATA.

† πῦρ, pyr, fire, and σῶμα, soma, a body.

mon mass. A transparent jelly-like tube, closed at one end, is studded outside with a great number of little tubercles of a firmer substance, but transparent and polished, each having an orifice at the tip, and a mouth opening into the common tube. In the water they float at the mercy of the waves ; but there is a motion by which the water is sucked into the tube, and entering the mouths is expelled in little streams from the external orifices. One species found in the Mediterranean (*P. Gigas*) attains a length of fourteen inches. Many of these moving masses of animals exhibit, as they float in the sea, a magnificent effulgence of phosphoric splendour that astonishes, while it enraptures, the midnight voyager. “ Nothing can exceed the dazzling light and brilliant colours that these floating bodies exhibit,—colours varying in a way truly admirable, passing rapidly every instant, from a dazzling red, to saffron, to orange, to green and azure, and thus reflecting every ray into which the prism divides the light, or which is exhibited by the heavenly bow.”*

The remaining Classes of the Mollusca, we must dismiss with a very slight notice, as they possess little to make them popularly interesting.

* Kirby.

CLASS V.—BRACHTIOPODA.*

A GROUP very limited in number, comprising animals enclosed within immoveable bivalve shells, generally affixed by a fleshy foot-stalk to the rocks. They are provided with two long spiral arms, which can be unfolded and drawn back, producing, by means of the *cilia* with which they are studded, powerful currents in the water. In *Terebratula*† *Psittacea*, in which these organs are of great length, Prof. Owen describes the mechanism by which they are unfolded, as very simple and beautiful. The stem of each arm is tubular, and contains a fluid, which, being acted on by the muscles spirally disposed that form the tube, is forcibly driven towards the extremity, and the organ is thus unrolled and projected. But the most remarkable circumstance in the structure of these animals is, that the whole mantle forms a respiratory organ, the blood being conveyed to all its parts by innumerable ramifications; while the *cilia* with which the whole surface is covered, by their incessant motion, bring ever fresh currents of water to be respired.

* Βραχίων, *brachion*, an arm, and πούς, *pous*, a foot.

† *Terebratus*, bored; one of the valves being perforated.

CLASS VI.—CIRRHOPODA.*

THIS Class is interesting to the naturalist, as exhibiting a structure which connects two very distinct great Divisions, so that it might, with almost equal propriety, be placed here or at the commencement of the ensuing Division.

While we find them covered with a stony shell, composed of many pieces, and invested in a mantle like the *Mollusca*, we see that they also have jointed feet, a mouth furnished with jaws, and *palpi*, and other internal organizations, which shew their affinity with the *Crustacea*. The well-known genus

Anatifa,† the Barnacle,

shall be our illustration of this Class, notorious as having been the subject of a most ridiculous opinion already alluded to, that a species of Goose was, in due course of nature, produced from its shell,—an absurdity which has unfortunately been *seemingly* sanctioned by the scientific appellations given to the species. The Barnacle is enclosed in a shell, having some resemblance to that of a Mussel, but formed of five distinct pieces, united by a tough

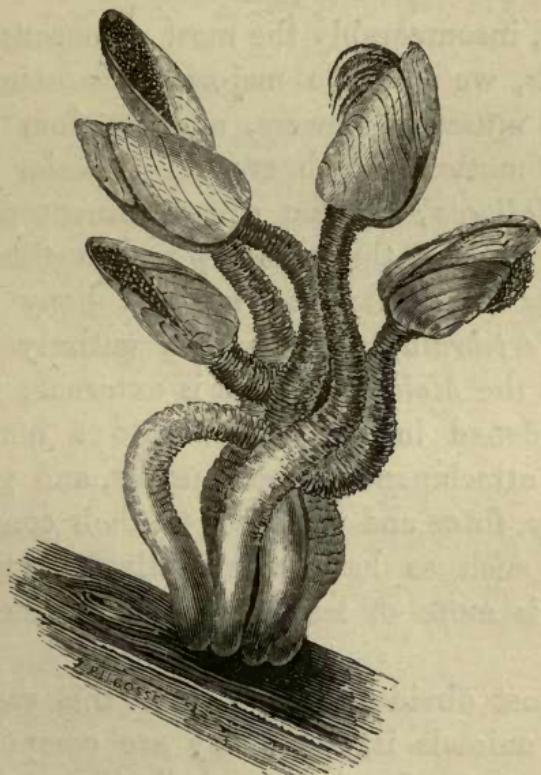
* Κιρρός, *kirrhos*, used for *cirrus*, a fringe, and πούς, *pous*, a foot.

† *Anas*, a duck, and *facio*, to make.

leathery membrane, which at the lower end is prolonged into a foot-stalk, sometimes many inches in length, endowed, notwithstanding its stiffness, with a considerable power of flexion. The valves, closed for the greatest part of their circumference, have a narrow opening in front, through which are protruded twenty-four jointed arms, (*cirri*), elegantly curved, and fringed with stiff hairs at every joint. These arms are arranged in pairs, six pairs being on each side, and each pair proceeding from a single stem ; the upper ones are longest, gradually diminishing downwards. At the bottom is placed the mouth, furnished with three pairs of jaws. The Barnacles are found attached to solid substances immersed in the sea, such as floating timber, the bottoms of ships, and even (as in a case recently brought to our notice) the bodies of living Whales. When a living Barnacle is examined under water, its motions are peculiarly pleasing, the whole array of the twenty-four *cirri* are suddenly thrown out, and instantly drawn back into the most elegant curves with great rapidity ; and thus produce a constant current, and form an effective casting net, by which any animalcules floating within reach are entangled and sucked into the mouth. From some investigations lately made by Mr. Thompson, it appears that these animals undergo a real transformation, a circumstance which would still more closely ally them to the *Crustaceans*. The young *Cirrhopod* is stated to be capable of swimming freely about like the minute Waterflea, (*Daphnia*), having six pairs

of swimming feet, a tail bent up under the belly, and endowed with two large eyes on footstalks! * So that, strange to tell, the *larva* seems to have a more complete organization than the adult animal.

* Zool. Researches, 4th. Mem. 1830.



COMMON BARNACLE (*Anatifa Lævis*).

THIRD GREAT DIVISION.

ARTICULATA.*

IN this, incomparably the most numerous Division of animals, we find the majority possessing organs of sense, muscular powers, and freedom and precision of motion, which are far superior to those of the *Mollusca*; so that some eminent naturalists have given them the higher place in the scale of Creation. They have no internal bony skeleton, as the *Vertebrata*, nor are they entirely destitute of any, as the *Mollusca*, but it is external; the outer skin, hardened in most cases into a bony crust, affording attachment to the muscles, and giving, by its solidity, force and precision to their contractions. Even in such as have comparatively soft bodies, the skin is more or less tough and leathery in its texture.

The most obvious character of this vast assemblage of animals is, that they are composed of a series of successive joints or rings, more or less discernible in all; but in the higher Classes, such as Insects and Spiders, they become, as it were, soldered together, so that only two or three divi-

* *Articulus*, a joint.

sions are well marked; and at length, in the more perfect *Crustacea*, such as the Crabs, almost all these distinctions are lost in the broad and solid shield which envelopes the whole.

Many of the animals before us, from the superiority of their organs, are fitted to live on the land and breathe the air, but many are still aquatic in their habits. We have, then, examples of all kinds of motion,—walking, running, leaping, flying, and swimming.

The brain is small, and sends forth two cords of nervous matter, which run in a parallel line along the belly, and unite at certain intervals into knots, or *ganglia*, whence the nerves of the body and limbs proceed.

This great Division is separated into four Classes, distinguished by the comparative development of their structure.

CLASS I.—CRUSTACEA.*

THE first three Classes of Articulated animals are sometimes called *Condylopes*,† from their being furnished with jointed feet, of which the fourth is destitute. They were included by Linnæus in his Class *Insecta*; but, though they possess many characters in common, there are essential differences between them. They have often more, never less, than six feet; their crust is generally horny in texture, more especially on the limbs; each joint is hollow, and contains the muscles of the succeeding one. The mouth is furnished with two pairs of jaws, which move transversely, and with certain jointed organs called *palpi*, whose office is not fully known; the head has, in general, one or more pairs of jointed filaments, resembling the *palpi*, but usually more developed and more diversified in form, termed *antennæ*. These projections have been, by various naturalists, supposed to be the organs of touch, of smell, of hearing, or of a sense not conferred upon us, and therefore of which we can have no idea. They are always furnished with eyes, which are hard, horny, and projecting: these are of two distinct kinds, one consisting of a simple

* *Crusta*, the shell of a lobster, &c.

† Κόνδυλος, *kondylos*, a joint, and πούς, *pous*, a foot.

polished glassy lens, the other of an immense number of lenses set in one *frame*, each having distinct vision, but immoveable, the whole representing a portion of a sphere, whose surface is cut into minute facets.

The *Crustacea* are the great aquatic division of this host, so organized as to be capable of respiring water; and though some species, as the Land Crabs, (*Gecarcinus*,) which spend a great deal of time, and travel to long distances, on land, breathe air; they are provided with a sort of vessel in which the sea-water can be carried, so as to allow the gills to be constantly bathed in it. Comparatively few inhabit fresh waters; for the most part they dwell in the ocean, where they increase and multiply to an astonishing extent. The majority of them have two pairs of antennæ; three pairs of jaws; three pairs of *foot-jaws*, organs of singular structure, uniting the form and functions of jaws and feet, the last two pairs in some cases assuming the office of feet, in others serving the purposes of mastication; and ten proper feet, terminating in a single nail: thus there are sometimes fourteen feet.*

In the Lobster, the Crab, and many others, the first pair of true feet take the form of broad and thick claws, the pincers of which, like a finger and thumb, are opposed to each other, and constitute,

* The fact is, that, properly speaking, the typical number of feet is seven pairs; but the anterior pairs are formed into foot-jaws in certain forms, in which case there are but ten feet; hence these are called *Decapoda*.

from their hardness, their muscular power, and the stout teeth with which they are armed, a very formidable weapon, as well as a substitute for a hand.

There is no part of the economy of these animals more interesting than the periodical rejection of their crust. Solid and unyielding as this is, it is obvious that it would soon present an obstacle to the increase of the growing animal, which could be surmounted only by its removal; the necessity for which is the more pressing, as some species attain a very large size, living to the age of twenty years, and growing till death. To the indefatigable Reaumur, we owe most of the information we possess on the mode in which this singular operation is performed. It seems usually to take place in the summer season, when food is abundant and the weather warm. The naturalist above-mentioned placed several specimens of the Cray-fish (*Astacus Fluvialis*) in perforated boxes, some of which were immersed in the river, and others kept in his house. In a state of freedom, the animal retires on the approach of its change into clefts of the rocks, holes, and similar places, to be free from interruption and danger during its helpless state. Remaining for some time without eating, it becomes thin; and meanwhile a new skin—the future shell, but yet soft and expansible—is formed between the old shell and the body. When this is fully formed, the animal becomes violently agitated, and throwing its body into various postures, rubbing its feet against each other, endeavours to loosen the

old shell in every part. The *abdomen* is now forcibly inflated ; and at length, after great exertion, the membrane which connects it with the *thorax* bursts, and the split extending on each side, the shield of the chest and head is thrown off in a single piece. The legs are now to be withdrawn, and this, particularly the liberating of the great claws, is the most wonderful part of the whole process. Some have supposed that the flesh, extremely wasted by the long fast, is drawn through the narrow joints as we draw our feet from our boots ; but this seems hardly credible, though the joints of the cast-off shell are certainly not split, nor separated from each other. It has been conjectured that the whole claw splits lengthwise to admit the withdrawal of the limb, and then closes again with so much accuracy, that no trace of such a division can be discovered. But this is more marvellous than the former conjecture. Mr. Jones mentions, that in a very recent specimen of a cast shell, which had come into his possession, "each segment [of the claw] was split in the neighbourhood of the joints, and the articulating ligaments ruptured,"* a fact which seems to us rather to favour the former notion. However, in some mysterious manner the limbs are extricated ; and after arduous exertions, the belly and tail are likewise freed, and the old skin remains sometimes in an unbroken piece, with the exception of the shield, an exact counterpart of the perfect animal. It may readily be supposed

* Anim. Kingd. p. 328 (*note*).

that an operation so critical must often prove fatal, and even those which survive are left in a state of extreme weakness and exhaustion. The limbs are so soft that they may be bent like wet paper ; but the body, perhaps from the tension of the muscles, is remarkably hard. Every part of the surface of the animal is seen to be renewed ; nothing is wanting in the slough ; the antennæ, the jaws, the eyes are here,—every hair is a case which enclosed another hair ! Even the shelly plates from which the muscles originate, the tendons by which they are inserted into the shell, the internal skin of the stomach, and even the teeth which are hidden there, are found in the rejected shell !

The pressure of the old shell being now removed, the animal suddenly increases in bulk, the new skin, as yet soft and flexible, allowing of great expansion ; but it rapidly hardens, a stock of shelly matter having been for some time accumulating in its stomach, in the form of two hard balls, commonly called *crabs' eyes*. This substance is now taken up and distributed to the surface, so that when the new crust has again acquired consistence, the balls are no longer found. This takes place in from one to three days.

Another interesting faculty conferred upon these animals, is the power of reproducing certain parts of their bodies with all their appendages, after they have been accidentally mutilated. " It appears, from the investigations of Reaumur, that this new growth takes place more readily at particular parts of the

limb, and especially at the joints, and the animal seems to be aware of the greater facility with which a renewal of the claw can be effected at these parts; for if it chance to receive an injury at the extremity of the limb, it often, by a spontaneous effort, breaks off the whole limb at its junction with the trunk, which is the point where the growth more speedily commences. The wound soon becomes covered with a delicate white membrane, which presents at first a convex surface: this gradually rises to a point, and is found on examination to conceal the rudiment of a new claw. At first this new claw enlarges but slowly, as if collecting strength for the more vigorous effort of expansion which afterwards takes place. As it grows, the membrane is pushed forwards, becoming thinner in proportion as it is stretched, till at length it gives way, and the soft claw is exposed to view. The claw now enlarges rapidly, and in a few days more acquires a shell as hard as that which had preceded it. Usually, however, it does not attain the same size, a circumstance which accounts for our frequently meeting with Lobsters and Crabs which have one claw much smaller than the other. In the course of the subsequent castings, this disparity gradually disappears. The same power of restoration is found to reside in the legs, the antennæ, and the jaws."*

The Class Crustacea is divided into two great sections, or Sub-classes, distinguished chiefly by the texture of their covering.

* Roget, Bridgewater Treatise, vol. i. p. 294.

SUB-CLASS I.—MALACOSTRACA.*

To this section belong almost all of the large species, and many of the smaller, with which we are most familiar. The appellation by which they are distinguished can be considered only as comparative, for their coverings are generally pretty solid, though less hard than the true shells of the *Mollusca*. They have either ten or fourteen feet, generally armed with a nail. In the Order *Decapoda*, all the three pairs of *foot-jaws* are appropriated to the mouth, and perform the office of true jaws; but, in all the other Orders, the hindmost and middle pairs of these organs are used as feet, thus increasing the number to fourteen. In each case, two pairs of the true jaws (*maxillæ*) are covered by these changeable appendages. The breathing apparatus (*branchiæ*) are generally situated under the edges of the shell, but in some they form tufts beneath the hinder part of the body. The eyes, two in number, are for the most part placed on a jointed and moveable foot-stalk.

There are five Orders in this section, of which we can notice only the first and most important.

* Μαλακὸς, *malakos*, soft, and ὥστρακον, *ostrakon*, a shell.

ORDER I.—DECAPODA.*

THESE are distinguished by the possession of five pairs of feet jointed to the *thorax*, or central division of the body, besides the foot-jaws, which are connected with the head; the first pair of feet are enormously developed into powerful claws or pincers; the others are but slender, but the first two pairs of these have feeble pincers in some genera, as the Lobster: the gills are situated under the edges of the shell, and are seven in number on each side. Among these we find the largest and most valued species, and the flesh of many of them is of delicate flavour, though not of easy digestion. They are carnivorous, and very voracious and indiscriminate in their appetite, feeding with eagerness on putrid substances. The land species even penetrate the graves, and feed on human bodies. They are courageous assailants, however, of living prey, and use their large claws with much address and effect. In large species, these organs are so powerful that one has been seen to seize a goat, and drag it from the shore into the sea; a feat the less surprising, when we consider that some species, the Thorny Lobster (*Palinurus*), for example, attain a length of several feet.

This order naturally divides itself into two fami-

* Δέκα, deka, ten, and πόδης, pouς, a foot.

lies, of which the Crab and the Lobster may be respectively taken as the representatives.

FAM. I.—BRACHYURA,* CRABS.

Every one is familiar with the general form of these animals, whose distinctive mark is, that the *abdomen*, commonly called the *tail*, is shorter than the *thorax*, or the chest, and folded under it, where there is a sort of groove to receive it. The abdomen, or tail, is of a triangular form and flat in the male; but in the female it is wider, and becomes convex, the eggs being carried about in large clustered masses between it and the thorax, preserved from falling out by four pairs of hairy filaments attached to the abdomen. The antennæ are comparatively short; the eyes have longish footstalks; the foot-jaws are short and broad, the outer pair forming a sort of lips. The gills occupy a large space on each side of the chest, composed of broad leaves or plates laid one above another, and pointing inwards, to which the absurd name of “*dead man’s fingers*” has been familiarly given. The general form of the body is somewhat oval, the abdomen being concealed, and the breadth of the thorax being usually greater than its length.

* Βραχύς, *brachys*, short, and οὐρά, *oura*, a tail.

Gecarcinus, the Land-crabs.*

These have a heart-shaped shell, appearing as if cut off behind; the eyes are club-shaped; the two middle pairs of legs are the longest. They are common in the tropical parts of America and the West Indies, where their highly curious habits have attracted the admiration of travellers. Their usual residence is in burrows, which they are said to close up during the time when they are casting their shell within. At this season, while the crust is yet soft, their flesh is highly esteemed, though sometimes unwholesome. Early in summer, when the rains descend, they leave the mountains in order to seek the sea, where they may deposit their eggs. In these annual migrations, they accumulate in such hosts, that the roads and fields are covered with them. Like a great army strictly disciplined, they march on in a straight line without breaking their ranks; they determinately scale houses, cross rivers, and surmount every obstacle. Frequently they enter the houses, making a noise like that of rats, and in the gardens commit great havoc, destroying fruit with their powerful claws. Their march is chiefly in the night, and they halt with great regularity at certain intervals. When they reach the sea, after bathing themselves three or four times, they retire to the neighbouring woods, where they repose a while; then the females return to the sea and de-

* Γῆ, *ge*, earth, and καρκίνος, *karkinos*, a crab.

posit their spawn. This grand object of their journey being accomplished, they set about returning in like order, guided by the same invisible but unerring Hand which had directed them before. From the exhausting effects of travelling, however, only the most vigorous reach the mountains at one effort; many are compelled to scatter themselves over the plains to recruit their strength. We have already spoken of the admirable provision made for the constant moistening of the gills of these animals, during their long wanderings on the land.

The Land-crabs, of which there are many species, do not appear to be very nice in their choice of diet. Captain Crow informs us that, in Bonny, on the coast of Africa, persons are buried under the floor of their own houses, and it is revolting to see the Land-crabs crawling out of holes in the floor from their obscene repast; notwithstanding, they are caught and eaten with relish. A negro, with whom the captain remonstrated on the subject, seemed to think this but a reasonable and just retaliation, a sort of payment in kind;—“Crab eat black man; black man eat he !”

The most common species in the West Indies is the *G. Ruricola*, which when young is of a lively blood-red colour, sometimes spotted with yellow, with a deeply-marked impression of the letter H.

Another genus, somewhat allied to these, (*Grap-sus*,*^{*)} has been called the Soldier. They assemble in great numbers, and when alarmed hurry to the

* Γράφω, *grapho*, to write.

water with a tremendous clattering, caused by striking one claw against the other. Their shell is inscribed with numerous irregular lines.

Ocypode, the Horseman.*

Rather more aquatic than the true Land-crabs, the Horsemen inhabit the sandy sea-shores near the mouths of rivers. They have short, nearly equal claws, and a very narrow abdomen. They form burrows in the sand, which they inhabit during the day, coming out chiefly after sunset. They have been celebrated from antiquity for their swiftness in running over the sand, which is so great that a horse can scarcely overtake them. Bosc observed a species (*O. Hippus†*) in Carolina, which he had some trouble in overtaking on horseback, and shooting with a pistol. They inhabit only warm climates.

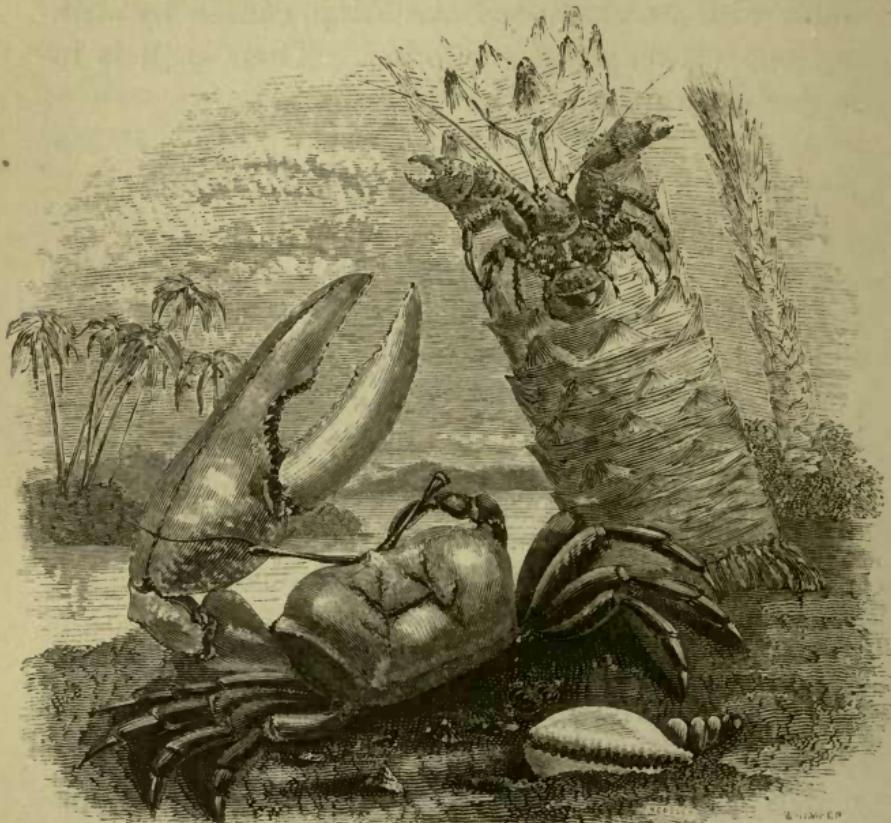
Gelasimus,‡ the Calling Crab.

This genus has club-shaped eyes, slender antennæ, and unequal claws; sometimes the right, sometimes the left, being greatly larger than the other. This disproportion, however, answers an useful end, for, retiring into its burrow, the Crab closes the entrance with the great claw, which prevents intrusion, and is likewise ready to seize passing prey. They have the

* Ὀκὺς, *okys*, swift, and ποῦς, *pous*, a foot.

† Ἱππεὺς, *hippus*, a horseman.

‡ Γελάσιμος, *gelasimos*, ridiculous.

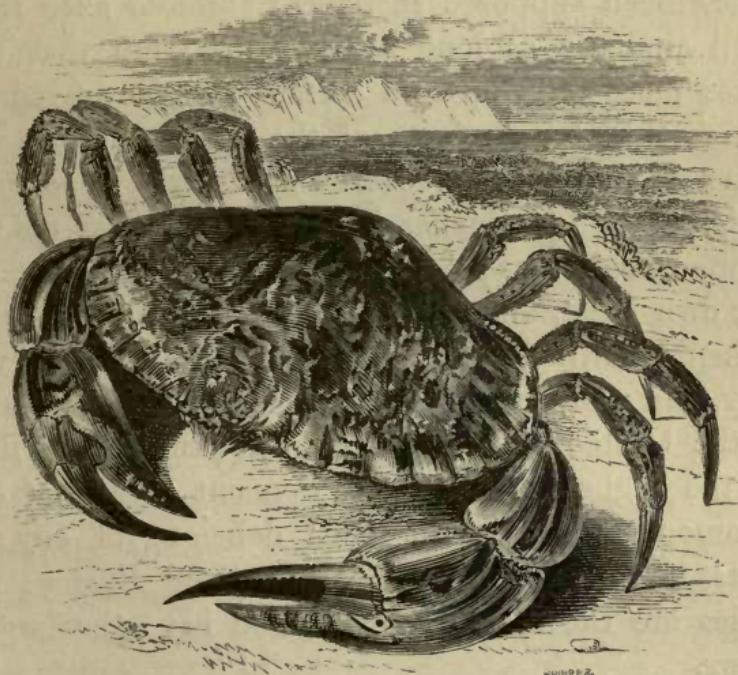


CALLING-CRAB (*Gelasimus Platydactylus*) ; and TREE-LOBSTER (*Birgus Latro*) in the distance.

habit of holding the large claw in the air in front of the body in a very ludicrous manner, as if beckoning to some one, whence their name ; this probably is an attitude of defence. They attack carrion in crowds, disputing possession with the vultures ; they inhabit (at least one species, *G. Pugillator*, found in America,) a burrow in winter, which is closed up for three months, so that it has to be burst open in spring.

Cancer, the Crab.*

The true Crabs are much more aquatic in their habits than any of the preceding, being essentially marine animals, though they often crawl about the rocky margins of the sea, especially at ebb-tide.



COMMON CRAB (*Cancer Pagurus*).

All the feet are exposed, and attached to the sides of the breast; the antennæ are so short as to be almost concealed; the claws are rounded. All the feet terminate in a pointed joint. The well-known

* Its Latin name.

and highly esteemed Crab of our markets (*C. Pagurus**) is found all round our coast, especially on rocky shores. Its shell is reddish-brown, almost smooth, the margin cut into nine scallops on each side, and three teeth in front. The claws are large, smooth, with black fingers, studded with a row of blunt knobs on the inner edge. It is sometimes found a foot wide, and weighing eight or nine pounds. It has been supposed that the *Crustacea* shed their shell annually as long as they live; but that this takes place only up to a certain age, is proved by the fact, that a specimen of the present species was taken in April, 1832, covered with Oysters, some of which were four inches long and six years old: it seemed to be in perfect health. It was found on our own coast, and is now in the British Museum. When moulting, our species becomes soft and watery, and unfit for food; but some, which are found in the United States and the West Indies, are then in the highest perfection. Pennant says, that our common species is the most delicious of any: it casts its shell between Christmas and Easter: the males are the most esteemed, and have the largest claws.

The Crab is caught in various ways. The children of fishermen often take small ones on a rocky beach at low water, by inserting a hooked stick into the crevices; the angry Crab grasps the intruding weapon with such tenacity that he is dragged out. In

* Πάγουρος, *pagouros*, the Greek name of some Crab. Arist.

similar situations, where they are numerous, a bait is attached to the end of a small cord, at the other end of which a stone is tied. When the tide flows, the Crab seizes the bait, which it drags to some hole, and the stone which it draws after it closes the entrance. As a stone may be dragged in the water, which cannot be moved by the same power exerted in a less advantageous manner, the animal finds itself a prisoner. The stone must be large enough to close the entrance of the Crab's hole, and not so heavy as to obstruct its movements.* We have seen boys take the common Shore Crab (*Carcinus Maenas*) in Poole Harbour, by letting down offal tied to a string among the rocks under water. The Crab seizes it with his claw, and will often suffer himself to be dragged out rather than let go his hold: in many cases, however, the hold is relinquished the instant the animal rises above the surface. But none of these plans are very efficient. The real crab-fisher uses pots or creels, which are formed of wicker on the same principle as a wire mouse-trap, allowing the entrance but not the exit of the animal; the aperture, however, in the crab-pot is on the top. Forty or fifty of these are baited with pieces of fish, loaded, and sunk together on a rocky bottom. A line from each pot, attached to a cork at the surface, indicates their position. The silly Crab eagerly rushes in; but, after feasting on the contained dainty, finds to his annoyance that he cannot get out. The solitude of his prison is,

* Penny Mag., 1837.

however, often relieved by the presence of Lobsters, Prawns, and other animals, his companions in captivity. After some hours, the fisherman goes to examine his pots, each float bearing a private mark to prevent mistakes of property. The demand is generally good, and if not immediately sold, they can be kept alive in *wells*, large boxes perforated, and floated in the water. The fishermen, when they bring their Crabs to market, as they are usually alive, prevent them from pinching by inserting a wooden plug into the joint of the claw, which paralyses the limb. They are brought alive even from Norway, in wells towed after the vessel; but they will live for two or three days entirely out of water. The Crab is out of season in May, June, and July.

Matuta, the Swimming Crab.

This is the principal genus of those Crabs which inhabit the ocean, rarely approaching the shore. The hindmost feet are dilated into a thin oval plate, fringed at the edge, which serves as a fin. The shell projects at each side into a long sharp spine. We have seen them numerous in the Atlantic, swimming swiftly about floating masses of the Gulfweed (*Sargassum Vulgare*). Their motions were amusing: having caught one or two about an inch in width, of a yellow colour with brown mottlings, we put them with some weed into a basin

of water, together with some pretty little Shrimps of a pellucid olive tint, with brilliant violet spots, numerous in the same locality. One of the Shrimps swam near a Crab, which instantly seized it with his claw; with this he held it firmly, while with the other claw he proceeded very deliberately to pick off small portions, (beginning at the head,) which he put, bit by bit, into his mouth: he continued to do this, in spite of the struggles of the poor Shrimp, sometimes shifting it from one claw to the other, until he had finished. He picked off all the members of the head and the legs before he began to eat the body, chewing every morsel very slowly, and seeming to eat it with great gusto; when nothing was left but the tail, he held it up and scrutinized it a moment, then rejected it, throwing it from him with a contemptuous jerk. These Crabs swim very fast, moving their legs rapidly, and coming to the surface or sinking at pleasure. They are rather wary, for often when we observed some of them crawling about a mass of weed, on endeavouring to reach it with the boat-hook, the moment the weed was touched the little Crabs would scuttle off and swim swiftly out of reach. The antennæ are kept in constant motion. Some of them which we examined had large bunches of black eggs, on which the abdomen was kept pressed down with much tenacity.

FAM. II.—MACROURA,* LOBSTERS, &c.

The abdomen is in these fully as long as the body, extended but curved. The extremity is furnished with some appendages, which generally form a flat fin. The under part usually has five pairs of false feet; the antennæ are generally long and projecting; the shell is longer and narrower than in the Crabs, and usually ends in a sharp projection from the middle of the forehead. They are all aquatic, and almost all marine.

Pagurus,† the Hermit.

The charge of usurping a habitation which was not originally his own, brought against the Argonaut, though “not proven” in that case, is in the genus before us incontrovertibly true. The abdomen, which resembles a sac, being soft and unprotected by a shell, needs an external covering, and God has given it a singular instinct by which this want is supplied. In some univalve shell, of almost any species of suitable size, the inhabitant of which is dead, the Hermit inserts its soft abdomen, holding fast the spire by means of some finger-like processes with which the tail is furnished. One claw is much larger than the other; the next two pairs of feet are of great size, but the two hindmost pairs are exceedingly small and weak, serving

* Μακρὸς, *makros*, long, and ὄυρα, *oura*, a tail.

† Πάγουρος, *pagouros*, the Greek name of a genus of Crabs.

but to turn the animal in his abode. We have seen a small species very numerous on one of the little Keys of the Florida Reef, dragging about the deserted shell of a *Trochus*, about an inch in height. With their claws and first two pairs of feet protruded, they run about very briskly; but if alarmed, they draw in their fore-parts, wrap one claw upon the head, and the other upon that, and thus present a strong barrier against outward violence, for it is surprising to see how very snugly and compactly the whole seems to lie, the smooth shelly surface just filling the cavity. The Hermit shews fight, however, sometimes, and can pinch pretty hard.

A genus allied to these, *Birgus*, but not inhabiting shells, is remarkable for its very singular propensity to climb trees. It is found in the Pacific Islands, where in the night time it ascends the palm trees to devour the cocoa-nuts. The species alluded to (*B. Latro*) is of gigantic size, and of such strength that if the animal has seized a stick in its claws, a child may suspend itself from the end without causing it to relinquish its hold.

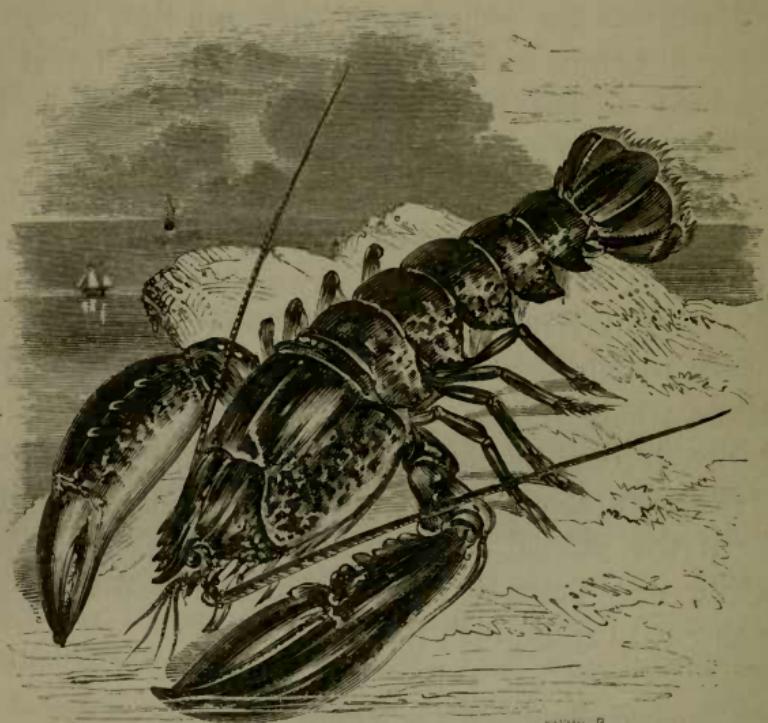
Palinurus, the Thorny Lobster.*

A genus remarkable for its large size and formidable appearance, being beset about the head, antennæ, and thorax, with bristling spines. It has no pincers, the fore-feet terminating in a strong simple claw, beset with bristles. Some species are

* The name of Aeneas's pilot.

said by Cuvier to attain a length of nearly seven feet, including the antennæ, and a species often seen in the London market is nearly a yard long. The flesh is esteemed, particularly in France.

Astacus, the Lobster.*



COMMON LOBSTER (*Astacus Marinus*).

Constituting an extensive article of food, highly esteemed for delicacy of flavour, and therefore the object of a valuable branch of commerce, the present genus is decidedly the most important of the

* Its ancient Greek name.

whole class. It is marked by the first three pairs of feet being all terminated by pincers; by the outside fins of the tail being widened and rounded, and by the sides of the shell being entire. The best known species are the common Lobster and the Cray-fish. An interesting account of the former (*A. Marinus*) is contained in a letter from Mr. Travis, of Scarborough, to Pennant. He informs us that the large ones are good only in winter, but the small ones are eaten all the summer. The pincers of one of the Lobster's claws are armed with knobs, and those of the other are toothed. With the former it keeps firm hold of the stalks of marine plants, while with the latter it cuts and minces its food very dexterously. The female does not cast her shell the same year that she produces eggs, or is "in berry;" when the spawn first appears, the eggs are very small and deep black; but when the time of the exclusion of the young draws near, they become brown, and as large as elderberries. The female continues to deposit eggs as long as any of that black substance remains in the body, which in boiling becomes of a bright red, and is called *the coral*. These eggs are hatched only in July and August, when many young may be seen swimming about, from half an inch to four inches in length. The Lobster is usually taken in pots, like the Crab; but on the Yorkshire coast, where the sea is more boisterous, the fishermen use a bag-net extended by an iron hoop, two feet in diameter, and suspended by three lines like a scale.

It is baited in the bottom with fish offal. In the day-time none are taken, except the water be thick; nor in those nights when the sea is luminous. In the water they run nimbly on their legs; but if alarmed they spring, tail foremost, to a surprising distance, as swiftly as a bird can fly. The fishermen can see them pass about thirty feet, and by the swiftness of their motion suppose them to go much farther. When frightened, they spring to their retreats in the rocks; and, what is surprising, will throw themselves into their hold in that manner through an entrance barely sufficient for their bodies to pass. Their ordinary weight is from one to two pounds, but they have been known to weigh six pounds. Any violent shock to the nervous system will cause the Lobster to throw off its claws; this will frequently happen when plunged into hot water, or into spirits. "Lobsters," says Pennant, "fear thunder, and are apt to cast their claws on a loud clap. I am told they will do the same on the firing of a great gun; and that when men-of-war meet a Lobster boat, a jocular threat is used, that, if the master do not sell them good Lobsters, they will fire him a salute." Old individuals are sometimes half a yard in length. The Lobster is found in the Mediterranean, as well as on the Atlantic shores of Europe; it also frequents the eastern coasts of North America. A vast number are taken on our own shores, but the main supply of the London market is drawn from the deep rocky inlets of Norway.

The Cray-fish or Craw-fish (*A. Fluvialis*) confines

itself to fresh-water, inhabiting the streams and lakes of Europe and Northern Asia; kindred species are found also in North America. It conceals itself under stones, and in holes in the banks, only coming out for food, which consists of Mollusca, small fishes, and decaying animal substances. It is said to live twenty years, increasing all the time. Those which inhabit clear running streams, are better flavoured than those of stagnant ponds. They are taken by sinking faggots of thorns, in the middle of which a mass of putrid flesh is placed. They are also caught by torch-light.*

Crangon,† the Shrimp.

The single species of this genus, which is of small size, has a single hooked claw, in place of the first pincers; the upper antennæ have but two threads; the spine of the forehead is short, the shell is horny, thin, and semi-transparent. The Shrimp which is so largely consumed in this country, (*C. Vulgaris,*) swarms in immense hosts on most sandy beaches. In Paley's Natural Theology, we have a very interesting notice of this species. "Walking," says the Dr., "by the sea-side on a calm evening, upon a sandy shore, and with an ebbing tide, I have frequently remarked the appearance of a dark cloud, or rather, very thick mist, hanging over the edge of the water, to the height perhaps of half a yard, and of

* Partington's Brit. Cycl. Art. "CRAY-FISH."

† Its ancient Greek name.

the breadth of two or three yards, stretching along the coast as far as the eye could reach, and always retiring with the water. When this cloud came to be examined, it proved to be nothing else than so much space filled with *young Shrimps*,* in the act of bounding into the air from the shallow margin of the water, or from the wet sand.—If any motion of a mute animal could express delight, it was this; if they had meant to make signs of their happiness, they could not have done it more intelligibly. Suppose then, what I have no doubt of, each individual of this number, to be in a state of positive enjoyment;—what a sum, collectively, of gratification and pleasure, have we here before our view!"†

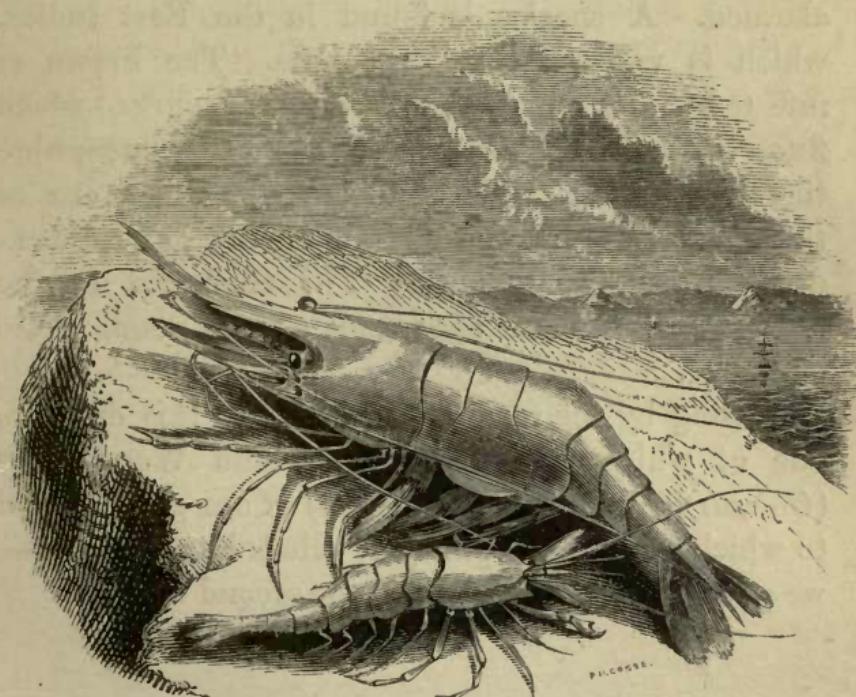
Shrimps are often taken by women and children wading to the knees, with a net fixed to a pole, the end of which is placed against the breast. In walking, the edge of the net is pushed along the ground, and the Shrimps, endeavouring to escape, are caught in the bag of the net. The fishermen in boats go into deeper water, and use nets, which they drag on the bottom by heavy weights. The principle, however, is the same. When alive they are of a greenish hue, but change by boiling, to the reddish brown they afterwards assume. The London market is supplied chiefly from the south-eastern coast.

* It is possible, however, that these may have been Sand-hoppers, (*Talitrus*, &c.,) belonging to another Order of the *Crustacea*.

† Brougham and Bell's Edit. Vol. ii. p. 113.

Palæmon, the Prawn.*

The Prawn is far superior to the Shrimp in size, beauty, and flavour. It is distinguished by having the anterior two pairs of feet cleft at the extre-



THE COMMON PRAWN (*Palæmon Serratus*), AND SHRIMP (*Crangon Vulgaris*).

mity, and by the stiff, sharp, curved, and sword-like horn of the forehead, cut into teeth on each edge. The common Prawn (*P. Serratus*) is four or five

* A fabled sea-god, and proper name of antiquity.

inches long, of a delicate pink hue, rendered more vivid by boiling.

It is much in demand, being deservedly esteemed, and is taken on the coasts of England, chiefly near a shelving sandy shore: some, however, are found at the mouths of rivers and even far up. Prawns swim well, and in various directions, particularly when alarmed. A species is found in the East Indies, which is vastly larger than ours. The Prawn is infested with a remarkable parasite, (*Bopyrus*,) which fixes itself on the gills, causing a very perceptible tumour on the outside of the shell. Under one of these pests, were found by Risso, eight or nine hundred living young ones. The fishermen in the Channel, consider these animals as very young Soles or Plaice.

Passing by the remaining Orders of this division, one of which contains the common Wood-louse (*Oniscus*) and Button (*Armadillo*) of our gardens, and to which the minute pest just alluded to belongs,—we pause an instant to notice the second section.

SUB-CLASS II.—ENTOMOSTRACA.*

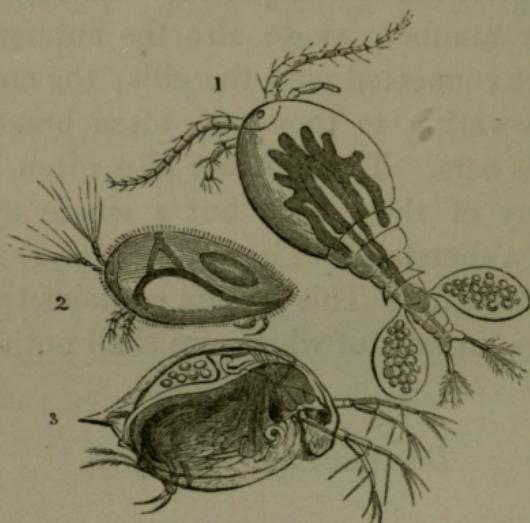
THIS division contains animals which are immensely numerous, but almost all of minute size, some being, in fact, only discernible with the aid of the microscope. They are all aquatic, and most of them are confined to fresh waters. Generally, they are covered with a thin, horny, and perfectly transparent shell, which is open at the lower part. The feet, which vary greatly in number, as do also the antennæ, are in many cases connected with the gills; the antennæ, or organs answering to them, are often branched, and are used as oars. The feet are also often branched. Very many of them have but a single eye, rarely placed on a footstalk. They appear to change their skin as insects do. This section contains two numerous Orders, in each of which, we shall notice a single genus.

Daphnia, the Waterflea.

No one can have peered intently into any collection of fresh water in summer, however small, without having observed hundreds of minute atoms, scarcely larger than the mites of cheese, swimming through the fluid in all directions, moving by little leaps or jerks. These tiny creatures are the Waterflea (*D. Pulex*), which we choose to represent

* *Ἐντόμον*, entomon, an insect, and *οστρακον*, ostrakon, a shell.

the Order BRANCHIOPODA,* or those in which the feet appear to serve the purpose of lungs or gills. The body is contained between two transparent oval plates, open on the under edge. Through this pellucid envelope the legs may be seen in constant motion, and, from the extreme delicacy of their covering, they present to the surrounding element a surface of sufficient extent for the purpose of exposing the blood to its action; while at the same time, by a beautiful provision, the more active and vigorous



WATERFLEAS: 1. *Cyclopa Communis*, 2. *Cypris Unifasciata*,
3. *Daphnia Pulex*.

their motions are, the more effectually will a current of fresh water pass along the breathing surface, to support the muscular energy. During the heat of the day, these little Waterfleas descend to a depth

* Βράγχια, *branchea*, the gills, and πούς, *pous*, a foot.

of six or eight feet, but at other times they crowd to the surface. Their food consists only of vegetable matters. They have but a single eye, whence their Linnæan name of *Monoculus*. Several other genera of equal minuteness and similar manners are often associated with these, one or two of which we have figured above.

Limulus, the King-crab.*

The animals of the other Order, PŒCILOPODA,† have very different structure and functions assigned to their feet, which are not branching; they are also destitute of the jaws of the other *Crustacea*. The King-crab or Horse-foot (*L. Polyphemus*‡) is an animal of considerable size, being sometimes two feet in length. It is common on the coast of America from New York southward, and in the West Indies. It has no distinct head: but its body is covered with a convex, semicircular shell, thin, elastic, and horny; to which is attached a long, pointed hard spine or tail, used as a formidable weapon by the Indians. Being of slow motion, and easily overset by the surf, the dead bodies of these creatures cover the shore in heaps, so that in Delaware Bay, one might walk on them for ten miles, without touching the ground. The hogs are regularly driven down to feed on them, and their bodies are drawn by waggon-loads to be used as manure.

* *Limulus*, awry or crooked.

† Ποικίλος, *poikilos*, various, and ποῦς, *pous*, a foot.

‡ *Polyphemus*, the name of a fabled giant, having but one eye.

CLASS II.—ARACHNIDA.*

THE grim and solitary habits, unprepossessing appearance, and blood-thirsty disposition of the animals we are now to consider, have made them more generally the objects of fear and abhorrence than any other *Invertebrata*. The beautiful adaptation of means to ends, the connexion between structure and instincts, is marked by the same wisdom and forethought, and fraught with the same interest in these, as in all other animals; but considered in themselves, *morally*, if we may be allowed the expression, there is nothing in them that is attractive, but much that is unamiable and repulsive.

These animals were formerly considered as Insects, with which great Class they were united; but they are distinguished by wide differences internal and external, by characters of great importance. The first great peculiarity is, that they are divided into but two principal portions, the head, which is distinct from the *thorax* in Insects, being here soldered to it, so as to form one piece. They have eight legs; only smooth eyes; no antennæ; and the greater number breathe by lungs, instead of air-tubes. They are the destroyers of the insect

* Ἀράχνη, *arachne*, a spider, and εἶδος, *eidos*, a resemblance.

races ; waging unceasing and merciless warfare against them ; some attach themselves to the bodies of various animals, and extract their juices through the skin : while a very few seem to live on vegetable substances.

The Class is divided into two Orders, distinguished by a variation in the mode of respiration. The first, which is by far the more numerous, displays more fully the peculiar organization of the Class ; the other approaching in many respects, the true Insects.

ORDER I.—PULMONARIA.*

THE first and most important Order breathes air by means of hollow sacs which open by little apertures beneath the body. There are always eight legs. The head is furnished with two organs which seem to answer to the *antennæ* of Insects, but which terminate in a poison fang, used in killing prey, and in many cases so formed as to act like pincers.

FAM. I. ARANEADÆ.†—SPIDERS.

“No animals fall more universally under our observation than the Spiders: we see them every where fabricating their snares, or lying in wait for their prey, in our houses, in the fields, on the trees, shrubs, flowers, grass, and in the earth; and if we watch their proceedings, we may sometimes see them, without the aid of wings, ascend into the air, where, carried by their web as by an air-balloon, they can elevate themselves to a great height.”‡ Their distinctive characters are as follow: their *palpi* are small, without any pincers; their abdomen is joined to the chest only by a slender footstalk, but is not divided into segments; this part is covered with a soft skin. At the end of the body are several little prominences like teats, each pierced with hundreds of

* *Pulmo*, Lat. the lungs.† *Aranea*, a Spider.

‡ Kirby.

orifices, from which issue at will threads of inconceivable slenderness, of a glutinous substance, but hardening instantly into a strong silk. This, as is well known, is woven by means of the hind feet, into nets of very varying texture, to entrap flying insects, into tapestry for their habitations, lines for their support, and cocoons for their eggs. Spiders have also the power of shooting forth a cluster of threads to the distance of several feet, which are wafted by the wind until they come in contact with some object, and form a bridge across the interval. We have this instant been amused by seeing a common Garden Spider (*Epeira Diadema*) use this mode of escape from a bit of stick set upright in a pan of water. It is supposed that some species dart out their web into the air in sufficient quantity to float them in the manner of a balloon: certainly they ascend without wings to a great elevation: and the air is sometimes filled with their webs, called *gossamer*.

Spiders, in all stages of their existence, are most eminently carnivorous, preying upon each other at every opportunity, and even the female devouring her mate with the most savage ferocity; a sight which, Reaumur says, filled him with horror.

A wound from a Spider will kill a Fly in a few minutes; we have already referred to an instance in which a West Indian Lizard (*Anolis*) died of the bite of our common Garden Spider;* it has even been stated that a large American species, hence called the Bird Spider (*Mygale Avicularia*), preys habitually on

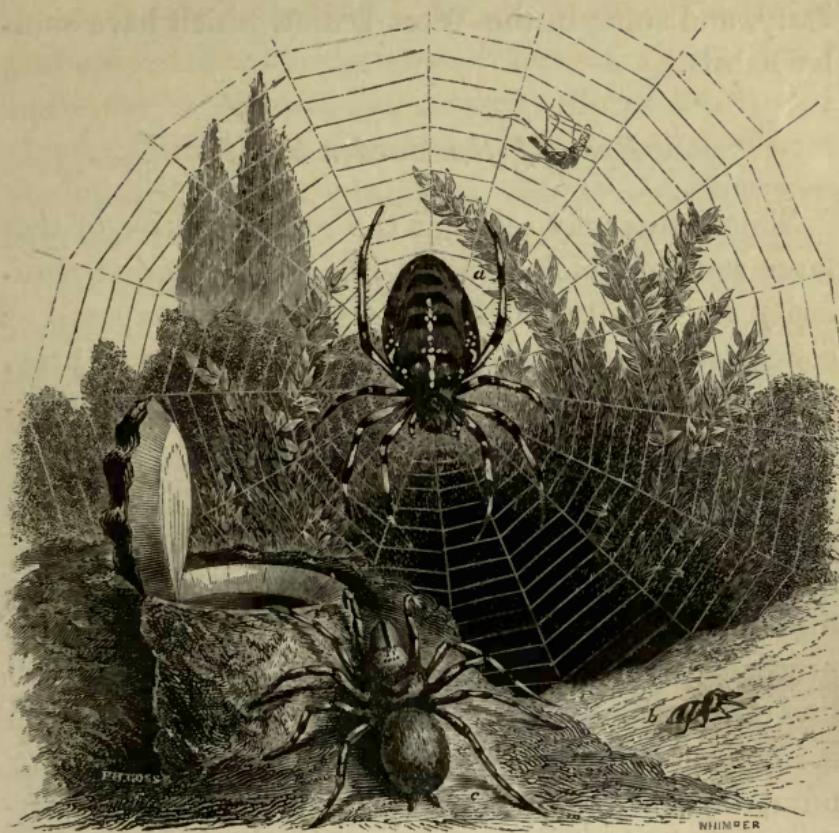
* See page 35.

the smaller Birds, but this appears to be fabulous; yet Latreille asserts, that the bite of some species in France has proved fatal even to man. They may therefore reasonably be mistrusted.

Mygale, the Mason-Spider.*

Of few animals are the instincts more curious or more admirable than of some of these. They dig burrows in the earth, sometimes two feet in depth, which are often so branched into galleries and passages, that it is impossible to trace them. The whole of the inner surface is lined with a silken web of exquisite warmth and softness; so that when the storms beat without, the Mason lodges snugly and cosily in a house of her own forming and furnishing. But, to exclude intruders who might not always be welcome, she forms a trap-door with a most astonishing sagacity. Collecting a number of pellets of earth, she binds them together with web, adding another layer of earth, and another of web, until it attains sufficient solidity; this is made accurately to fit the mouth of the tube, which is strengthened with a stout circular frame, into which the door shuts, and to which it is fastened by an elastic hinge, of very strong web. Outwardly this door is so rough with earth, that it would never attract notice, but internally it is perfectly smooth, soft, and convex, shutting close down by the spring of the hinge. On the side opposite to the hinge, are left some small holes

* Μυγαλῆ, *mygale*, the Field Mouse.



THE GARDEN-SPIDER (*Epeira Diadema*), MASON-SPIDER (*Mygale Cæmentaria*), and HUNTING-SPIDER (*Salticus Scenicus*).*

in the silk, into which the Spider, when at home, inserts her claws, and thus, when fearful of intrusion, holds her door with all her might, and even if half opened, often snatches it out of the hand. If exposed, however, she appears stupefied, and submits without resistance. This species (*M. Cæmentaria*) is found in the South of France, others are found in

* In the cut, the earth is represented as having been removed in part from the cell of the Mason-spider, in order to shew its form.

Italy, and some in the West Indies, which have similar habits.

Epeira, the Garden Spider.*

This genus may serve as the representative of that large section which spin net-like webs of great regularity and beauty, sitting in them either exposed or concealed, to wait for the entanglement of prey. Every one is, of course, familiar with our great Garden Spider (*E. Diadema*) whose yellow abdomen is handsomely marked with black bands, and a series of white dots. Having formed the foundation of her net, and drawn the skeleton of it, by spinning a number of rays converging to the centre, she next proceeds, setting out from that point, to spin a spiral line of *unadhesive* thread, like that of the rays, which it intersects, and to which she attaches it, and after numerous circumvolutions, finishes it at the circumference. This line, together with the rays, serves as a scaffolding for her to walk over, and it also keeps the rays properly stretched. Her next labour is to spin a spiral line from the circumference towards the centre, but which stops somewhat short of it; this line is the most important part of the snare. It consists of a fine thread, studded with minute, viscid globules, like dew, which, by their adhesive quality, retain the Insects that fly into the net.† The skilful constructor then stations herself in the very centre,

* Ἐπί, *epi*, upon, and εἴρος, *eiros*, spun wool.

† Mr. Blackwall in Zool. Journ. vol. v. p. 181.

where she patiently hangs, head downward ; and, her feet extended upon the rays, "lives along the line," until the arrest of some unwary Fly rouses her to vigorous action. Approaching the struggling victim, she pours out her glutinous web in extraordinary profusion, directing it by means of her hind feet in a broad and dense ribbon around the Fly, whose every limb is rapidly enveloped by it. The pointed poison-claws are now plunged into its body, and the juices sucked at leisure. If, however, for some reason, she do not choose to devour the Insect, it being too formidable or perhaps unpalatable, she shackles it with a little web, and then with great skill and ease bites asunder the threads which hold it, and drops it clear of the net.

Salticus, the Hunting-Spider.*

These little creatures, scorning the stratagem of a web, seize their prey by open violence ; bounding upon it like the lion or tiger. Few persons can be so unobservant as not to have often seen a little black and white Spider (*S. Scenicus*) with short, thick legs, and lengthened form, not quite so big as a House-fly, which glides and jumps hither and thither on sunny days, on window-sills, palings, &c. Always vigilant, whenever he sees a fly settle near him, he cautiously glides to it, often without turning round, until, being arrived within a few inches, he suddenly leaps upon his prey, and very rarely misses it.

* *Salto*, to leap.

Strange to see, he manages to leap upon a perpendicular surface with equal precision, returning to the plane from which he started ; but this is effected by means of a thread, which, before he leaped, he cunningly attached to the surface.

Argyroneta, the Water-Spider.*

Forsaking the land, the sphere of action of its kindred, the little animal before us presents the strange paradox of a creature formed only to breathe air, residing habitually under water. Admirable, indeed, is the power and skill with which its beneficent Creator has endowed it for this purpose. He has taught it to spin, beneath the surface of still water, a bell of silk, firmly moored by threads to aquatic plants. This it fills with air conveyed from the surface in the following manner. It usually swims on its back, and after coming to the surface, its body is enclosed in a bubble of air, which it strangely retains in its progress, and which shines like a little ball of silver. Entering the diving-bell, the Spider discharges this air, and again comes to the surface for more, until its house is filled with air. Here it watches for water Insects, and even passes the winter, having first closed up the mouth.

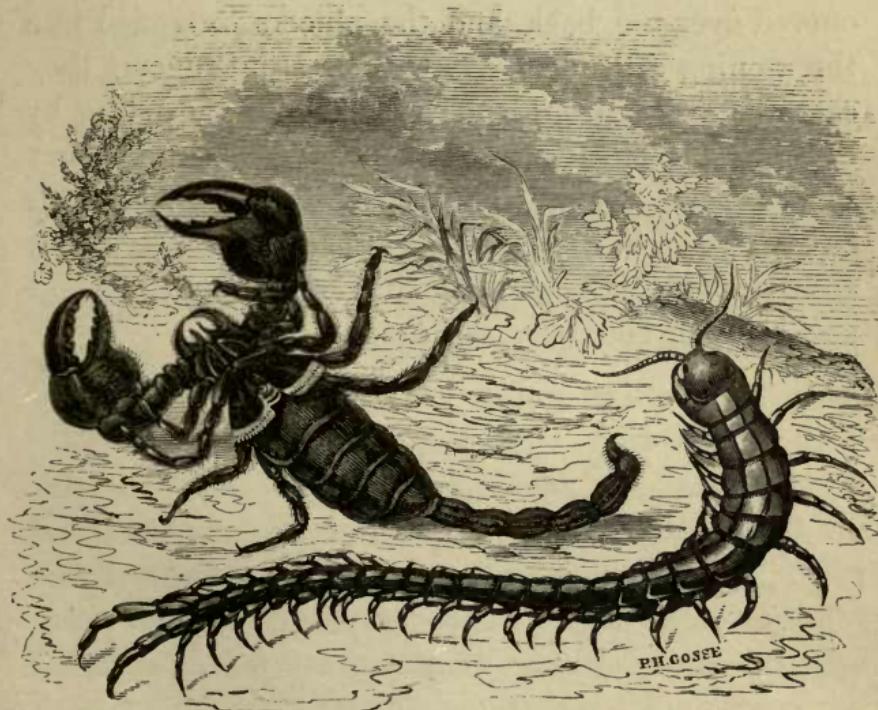
FAM. II. SCORPIONIDÆ.—SCORPIONS.

Fortunately we have not the same familiarity with this family as with the preceding ; no species of Scor-

* Ἀργυρός, argyros, silver, and νέω, neo, to swim.

pion being a native of our country. They differ from the Spiders by having very large *palpi*, terminating in broad pincers, closely resembling those of a Lobster; an abdomen composed of distinct segments, but broadly joined to the chest; the whole body covered with a hard shelly crust.

Scorpio, the Scorpion.*



THE COMMON SCORPION (*Scorpio Afer*), lying on its back ; and THE
AFRICAN CENTIPEDE (*Scolopendra Guinensis*).

The true Scorpions have, at the base of the abdomen, two moveable plates, toothed like a comb,

* Σκορπίος, skorpios, its Greek name.

the use of which is unknown. The body terminates in a long knotted tail, the last joint of which is armed with a hooked, poisoned sting, exceedingly sharp. Wounds inflicted with this weapon by the large species of hot climates, are attended with serious and alarming symptoms even to man, but are not often fatal.

They usually lurk under stones, in ruined buildings, caves, &c.; but run with swiftness, with the tail curved over the back, and the pincers extended in a threatening attitude. With their stout pincers they catch large Beetles, Locusts, &c., which they sting by bringing the tail forwards, and thus kill, preparatory to devouring them. These insidious and venomous creatures are in the Holy Scriptures used as types or emblems of malignant Spirits: a notion prevalent also in other countries and ages.

ORDER II.—TRACHEARIA.*

THE few animals that constitute this Order breathe not by lungs, but by air-pipes, which either radiate or branch to every part of the body; these communicate with the air by a single orifice, (*spiracle*,) on each side: there is no heart, and not more than four eyes, sometimes, indeed, only two.

Chelifer,† the Book-Scorpion.

These little creatures which look like Scorpions in miniature, but destitute of a tail, are often seen crawling backwards or sidewise, in old books, insect-cabinets, and dried plants, where they search for minute Insects. They run rather swiftly, and generally with the claws extended. Kirby says, that they are found upon Flies;‡ and we once took, in the Southern United States, a specimen of *Elater Ocellatus*, which was infested with numbers of these parasites. As they were much larger than the mites (*Leptus, &c.*) which commonly swarm on insects, and presented their prominent pincers, they caused the Beetle to assume a very odd appearance.

* *Tracheæ*, air-pipes.

† Χηλὴ, *chele*, a crab's claw, and φέρω, *phero*, to bear.

‡ Bridg. Tr. ii. 303.

Phalangium, the Shepherd-Spider.*

In these animals, familiarly called Father-long-legs, and Harvest-men, we find the abdomen no longer distinct from the trunk, but the whole body assuming a rounded or oval form. They are furnished with crooked *antennæ* which take the form of pincers; the *palpi* are merely pointed; they have eight legs, of great length and slenderness, which will move for a long time after being separated from the body; they have but two eyes. They are very common, especially in autumn; are carnivorous in their habits, feeding on small Insects, which they appear to overtake by swiftness of foot.

Acarus,† the Mite.

Most of these animals are so small as to be almost invisible without a microscope. Their body is undivided, their legs short; they have two pincers, but very small, and no visible *palpi*. Some of them, as the Cheese-mite (*A. Siro*), devour the food of man, in which they multiply prodigiously. Others attack living animals and even man himself, insinuating themselves beneath the skin, and causing troublesome diseases, as that of the itch, (*A. Scabiei*,) and even producing incurable and fatal ulcers. So minute and feeble an instrument may execute the punitive designs of God!

* Φάλαγξ, *phalanx*, a kind of Spider.]

† "Ακαρί, *akari*, an exceedingly minute animal.

Ixodes, the Tick.*

The organs of the mouth form, in this genus, a protruding sucker or beak, which it plunges into the flesh of living animals, and by which it adheres so firmly as scarcely to be torn away. They swarm in hot countries, in woods and damp places; climbing to the top of the herbage which grows by the sides of paths and roads, they hold on by the hind feet, and wave the others in the air; the instant any passing animal, or even man himself touches them, they fasten themselves, and instantly bury their sucker in the skin. Here they continue sucking the blood, until they become distended to an enormous size. We have seen in North America, a species (*I. Americanus*) not more than an eighth of an inch in diameter, and as thin as paper, become swollen to nearly the size of a horse-bean. The poor brutes become sadly infested with them, especially in parts which they cannot reach, such as behind the ears.

Another genus of Ticks (*Leptus*)† preys upon Insects, such as Bees, and various Beetles; swarming so upon them as frequently almost to conceal the animal, and to cause death from exhaustion.

* Ιξωδης, *ixodes*, adhesive.

† λεπτός, *leptos*, very small

CLASS III.—INSECTA.*

WE have now arrived at a Class of animals which commend themselves to our notice on many accounts. First, by their overwhelming numbers; swarming in countless hosts in every country, from the Equator to the Polar Sea. A hundred thousand species have been already named and described! The wonderful instincts displayed by many arrest our attention; the arts and wiles employed in pursuit or escape; the provident care taken for the future generation; the admirable skill manifested in constructing their habitations, often superior to anything seen in the higher classes. Many are useful in the arts: providing man with food, with clothing, with medicine, with dyes. The beautiful forms, and brilliant tints with which many are adorned are almost unequalled: multitudes of Beetles shine in green and gold, or metallic crimson, or are even dusted with glittering gems; some of the *Neuroptera* have their graceful and slender bodies carried on four long glassy wings, whose exquisitely delicate net-work would shame the finest lace; while the sylph-like wings of the Butterflies, covered with a mosaic of the richest hues, ar-

* *In*, into, and *sectus*, cut.

ranged in patterns ever varying, yet ever tasteful, render these children of the sun the most elegant of earthly creatures. Finally, the transformations to which all are subject complete our astonishment, appearing at first view to realize the wild doctrines of Pythagoras. A little egg is laid upon a leaf, which in a few days produces a spiny caterpillar. This grows, and grows, changing its skin from time to time, until by and by we see it hanging in the air, suspended by a little knob of silk which itself has spun. Presently the skin is thrown off once more, but instead of a long cylindrical caterpillar, we see a mummy-like chrysalis, without feet, but with projecting points and corners here and there, often glittering with golden spots. It hangs quietly thus for a week or two; then, splitting down the back, a painted Butterfly emerges, which, after drying her beautiful wings in the air, sails away to the flowers and fruits in the genial sunshine. These changes have been aptly used as an emblem of the Resurrection, and even among the Greeks the name of the Butterfly, Ψυχή, signified also the soul.

Insects have (in their adult state) six legs, not very materially varying in form; a head, chest, and abdomen, quite distinct from each other, often united but by a slender stem; two jointed *antennæ*, often variously adorned; four or six palpi resembling the *antennæ*; two pairs of jaws working horizontally, sometimes, however, modified into a hollow tube for sucking; two compound eyes, and, in most cases, three simple eyes also. The body is defended by a

horny skin, in some assuming a shelly hardness. The great majority have two pairs of wings, though in one order the second pair are scarcely to be recognised. They breathe by air-pipes (*tracheæ*), which communicate with the air through breathing holes, which are placed on each side.

These little creatures fly in the air, crawl on the earth, or swim in the water. They generally eat living plants, but many prey upon each other, and some devour decaying animal substances. As no Insect grows after it has attained the perfect state, food is chiefly needed in the earlier or caterpillar stage. Many do, however, still continue to feed, particularly such as are carnivorous.

Latreille divides the Class into twelve Orders, most of them distinguished by the presence, number, and form of the wings.

ORDER I.—MYRIAPODA.*

THESE present many disagreements with true Insects, whence most modern Naturalists have made them to compose a small Class of themselves; but at present we follow Latreille, in noticing them here. They are destitute of wings; the body is lengthened, and divided into a number of segments or joints, each of which (usually) bears two hooked and pointed feet. The Order comprises but two Families, which we may almost consider as genera, the Millipedes (*Julus*†), and the Centipedes (*Scolopendra*‡). The first are distinguished for their slow sliding motion, their half cylindrical form, their very numerous feet, sometimes amounting to more than a hundred, and their habit of rolling themselves into a close spiral when touched. They resort to damp and dark places, such as under stones and moss, and still more commonly beneath the bark and in the wood of decayed trees. They are considered harmless, feeding on decomposed vegetable matters. Some species emit a very rank, disagreeable odour; and a large North American species (*J. Marginatus*) is commonly reputed poisonous, if it be accidentally bitten or swallowed.

* Μυριάς, *myrias*, ten thousand (many), and πούς, *pous*, a foot.

† Ἰούλος, *ioulos*, an insect with many feet, which crept on walls.

‡ The Greek name of the Centipede.

The Centipedes are much better known, and often seen : they have a large flattened body, with many joints, usually hard and polished ; the hindmost feet are usually long, and directed backwards.* They crawl with great swiftness, pursuing their insect prey over the ground, but generally avoid the light. Several small species are common in our gardens, but in hot climates they grow to a great size, and are much dreaded. The great Centipede of the West Indies (*S. Gigas*) is more than a foot long, and very venomous : the second pair of feet terminates in a strong claw, which is pierced at the point like a Serpent's fang, and emits a poisonous fluid into the wound which it makes : the bite of this species, though rarely fatal, is more powerful than the sting of the Scorpion. Some of the Centipedes, as *S. Electrica*, a British species, are luminous.

* For a figure of this genus, see p. 305.

ORDER II.—THYSANURA.*

THE animals of this small Order, the first of Insects proper, have but six feet, and no wings, the extremity of the body being furnished with bristles. Some of our readers may have occasionally seen a little silvery creature running swiftly when disturbed from crevices in the woodwork of houses, or under damp boards, with long bristles behind, extended in form of a trident. This is the *Lepisma† Saccharina*; its body is not more than half an inch long, of a bluish silvery hue, covered with minute scales, which come off on the finger, if touched. It probably feeds on decaying matters.

The other genus, for the Order contains but two, is a group of much more singular creatures: from the use of the tail bristles, they are usually denominated Spring-tails (*Podura‡*). They are very small Insects, with soft bodies; the tail ends in two bristles, which can be bent under the belly, the position in which they are usually carried; when the Insect wishes to leap, it throws these bristles suddenly out, which, striking the ground, act as a spring, forcing the Insect to some height in the air. It usually falls on its back, and at the moment of alighting, the bristles may be seen extending straight from the

* Θύσανοι, *thysanoi*, bristles, and οὐρά, *oura*, the tail.

† Λεπίσματα, *lepisma*, a scale.

‡ Πούς, *pous*, a foot, and οὐρά, *oura*, the tail.

tail ; they are, however, immediately bent under the body again. Several species of these minute creatures, scarcely larger than a flea, may be often seen leaping about the surface of water in tubs, and damp places ; and one still smaller, of a greyish black, accumulates in countless numbers on water in ruts and horse-prints on roads, looking like grains of gunpowder, and frequently completely hiding the surface. Another species we have noticed in Canada, which appears in numbers, hopping about the surface of snow, just after it has fallen.

This genus seems to be allied to the *Myriapoda*, in having simple eyes arranged in a series on each side of the head, as is the case with the *Scolopendra*. But while the *Myriapoda* have but four such eyes on each side, the *Podura* has eight, set in an oval space.

ORDER III.—PARASITA.*

THIS Order contains a few very diminutive animals, but too well known by the name of Lice, *Pediculus*, *Nirmus*, &c. In their characters they agree with the preceding Order, except in having no bristles at the tail; and in having but two simple eyes. They live on the bodies of the superior animals, Birds, Mammals, and even on Man, clinging to the hairs or feathers by means of two opposable claws with which their feet are armed. Thus protected and concealed, they suck the blood, and multiply so as often to become a serious evil, aggravated by the habits of uncleanness which foster their increase. Of the four species which infest Man, none abound on adults, except in connexion with the most sordid filth. The amiable and excellent Mr. Kirby suggests that these insects, like other instruments employed by God to visit the sins of mankind, may be intended to produce a sanative effect, as well as to punish; possibly preventing the diseases which habitual disregard of cleanliness would otherwise generate.†

* Παράσιτος, *parasitos*, one who lives on another.

† Bridgew. Treat. ii. 316.

ORDER IV.—SUCTORIA.*

CONSISTING, like the last Order, of but a single genus, *Pulex*, the Flea, these agree with them also in deriving their nutrition from the blood of other animals. They differ from them in the anatomical structure of the mouth, and in undergoing a true transformation, which the former do not, changing their skins only, but not their form. From their agile motions, and the clean glossy character of their armour, as well as from their having no particular predilection for filth, the Fleas are not regarded with the same disgust as Lice, though they are by no means general favourites. The form of the Flea (*P. Irritans*) is oval, much flattened sidewise, with a very small head; the skin forms a hard, highly polished crust; the legs are strong, the hindmost especially, and formed for leaping; and its strength is so great as to enable it to perform feats of agility which, when its size is remembered, are truly astonishing. The Jigger (*P. Penetrans*) of the West Indies is far more mischievous than ours; entering into the skin of the feet, where it deposits its eggs in a ball as large as a pea. These, if not extracted, soon produce such a colony of young Fleas in the living flesh, as to cause a malignant ulcer, sometimes followed by mortification and death. The Negroes, however, readily extract them, and heal the wound.

* *Sugo*, to suck.

ORDER V.—COLEOPTERA,* BEETLES.

THIS is by far the most numerous of all the Insect Orders, the species already known being probably not much less than fifty thousand. The character which at once distinguishes it is, that the first pair of the four wings are of a leathery or crustaceous texture, and form, in a state of rest, two shields, meeting in the middle with a straight edge through their whole length, beneath which the hind wings are concealed. The former pair, though commonly called, for distinction, wing-cases, (*elytra*,†) and though so peculiar in form and texture, are nevertheless true wings in structure and position. The hinder wings, which are much larger than the *elytra*, are more or less folded upon themselves, when at rest. In a few species, they are wanting, and then the *elytra* are, as it were, soldered together. The head is furnished with two compound eyes, but no simple ones; two mandibles, strong and horny, each like a sharp hooked tooth, and two jaws beneath them, more membranous: these last bear either one or two pairs of feelers, (*palpi*), and another pair proceeds from the under lip. From the neighbourhood of the eyes arise the jointed *antennæ*, one on each side, the use of which is not known: these assume various forms.

* Κολεός, *koleos*, a shield, and πτερόν, *pteron*, a wing.

† Ἐλυτρόν, *elytron*, a case.

The whole skin is usually firm and hard in texture, except on the back of the abdomen. The first state of these Insects, called the *larva*, resembles a worm, generally pale or brownish, with a scaly head, and six feet. In the next state, the *pupa*, it is motionless, the limbs being wrapped together, though distinctly visible; and it takes no food.

We cannot, of course, enter into the subordinate divisions of this immense assemblage, but must content ourselves with a very slight notice of a few principal forms. The subject is inexhaustible.

The first rank is universally assigned to the carnivorous tribes, chiefly contained in three great genera,—*Cicindela*,* *Carabus*,† and *Dyticus*.‡ The first, often known by the name of Tiger Beetles, from their fierce voracity, and of Sparklers, from their brilliant colours, pursue other Insects with great agility and vigilance on sandy roads, particularly in sunshine. They run with exceeding swiftness, and take flight on being approached, alighting at a short distance, but are again on the wing in an instant if pursued, so that it is difficult to surprise them. They are admirably fitted for their employment: their legs are extremely long and slender; their bodies flat; their eyes large, round, and prominent, and their mandibles long, slender, hooked, and exceedingly sharp. Their *larræ* have the same appetite; and are furnished with jaws, even more tremendous, and sickle-shaped; they inhabit holes, in

* The Latin name of the Glow-worm.
species of lobster.

† Κάραβος, *karabos*, a
diver.

the mouth of which they watch for prey. This tribe of Beetles is usually green or purple, with some white spots.

The *Carabi*, or Ground-beetles, seem to have the same instincts, but are not quite so evidently gifted and fitted for them. They rarely, if ever fly, and though they are swift in running, are less so than the preceding; their legs are shorter, their jaws less sharp, their eyes less prominent. Still they are highly predaceous, devouring any other insects; the larger species even often preying on the smaller. Some are furnished with a highly caustic liquor, which is discharged in self-defence; it causes a smarting pain to the skin, and gives out a strong acid smell. Sometimes it is attended with a smoke, like the discharge of a little gun, as in the Bombardiers (*Brachinus*). Some of this tribe are of rather large size, ornamented with beautiful colours, golden-green, coppery, or black with purple gloss.

Another tribe of powerful and rapacious Beetles is known by the name of Water-beetles (*Dyticus*). They are of a flattened oval shape, convex above and below, with no prominences, a form well adapted for swift motion in water: their hind feet are fringed with stiff hairs, forming broad and powerful oars. They swarm in every pool; and may frequently be seen coming to the surface, where they thrust the extremity of the abdomen out of water, to breathe; but on the slightest alarm, down they dart and scuttle away among the mud. The *larvæ* have a soft body tapering to the tail, somewhat hairy, with a hard

scaly head, and monstrous jaws; they devour even tadpoles, and young fishes. Allied to these, is that merry little creature the Whirl-beetle (*Gyrinus**), which in little parties skims round and round in tortuous figures, with a velocity that the eye cannot follow. Diving on the slightest approach, each carries with him a bubble of air, sparkling like a little pearl.

As the preceding may be considered to represent the Cats and the Falcons, so we may find such an answer to the Hyænas and Vultures in two families which feed on decomposing animal matters. They form the two Linnæan genera, *Staphylinus*† and *Silpha*,‡ with others which we cannot notice. The former, often called Rove-beetles, are of repulsive appearance, the body lengthened, and generally deep black, the elytra very short, not nearly covering the abdomen: they diffuse an intolerable odour. Some of the large species, when disturbed, turn up the body perpendicularly over the back, and stretch wide open their formidable jaws in a most threatening attitude. They frequently feed on maggots, worms, &c., as well as the decaying flesh which they frequent. The *larva* much resembles the perfect insect, except in the want of elytra and wings.

* Γυρόω-ῶ, *gyro*, to move in circles.

† Σταφύλη, *staphyle*, a perpendicular.

‡ Σίλφη, *silphe*, a cockroach.

The Burying Beetles (*Silpha*) are more exclusively carcass-eaters. In some mysterious manner they find out any putrescent substance and flock to it in great numbers, where none were to be seen before. If the matter be large, they burrow holes in it, crawling in and out in a disgusting manner ; but if small, as the carcass of a mouse or a sparrow, they excavate the earth beneath it until the flesh is actually buried, its grave being gradually dug by these industrious sextons ; the eggs are then deposited in it, and it is left to decay for the benefit of the future progeny. We believe that the "worms," so inseparably associated with our ideas of the grave, are, if not imaginary, the *larvæ* of these and similar Beetles : certainly they have no kindred with the common Earthworm, as is vulgarly supposed.

From these carcass-eaters, we proceed to another set of useful scavengers, whose office it is to remove out of sight ordure, &c., that would otherwise accumulate offensively. The chief of these constituted the immense genus *Scarabæus** of Linnaeus, united however with others, whose habits and forms were essentially different. Of the former, our common Dorr, (*Geotrupes*† *Stercorarius*,) whose steel-blue armour and "drony flight" are well known, is a good example. Many of this very large family

* Their ancient Latin name.

† Γῆ, *ge*, the earth, and τρυπάω, *trupao*, to bore.

devour earth, the roots of vegetables, &c., in the *larva* state. The *larvæ* are large, white, and helpless, residing under ground ; the hinder parts, which are very thick, are bent under the body : that of the Cockchafer, (*Melolontha** *Vulgaris*,) often so de-



THE GOLIATH-BEETLE (*Goliathus Drurii*), and THE HERCULES-BEETLE (*Dynastes Hercules*).

structive to pastures, is familiar. Many of this tribe are distinguished by curved projections from the thorax and head, often of vast length and size, and of the most singular forms ; and among these are some of the largest Beetles known, the giants of the Insect race. We may mention the Hercules, (*Dy-*

* Its ancient Greek name.

*nastes** (*Hercules*), nearly six inches long, and very broad. Others, also very large, (*Goliathus*,† &c.) are noted for the metallic splendour of their green *elytra*, an idea of which may be formed from our own common but very handsome Rose-beetle, (*Cetonia Aurata*), so often found on flowers, like many of its family. The *larvæ* of all these last appear to feed on decaying wood, as do those of another family allied to this, the Stag-beetles, (*Lucanus*,‡) which appear however to attack trees in a much earlier stage of decay, boring long galleries into their substance while yet standing, and sometimes while yet alive. The perfect Stag-beetle is distinguished for the length and stoutness of its mandibles, which take the appearance of stags' horns; sometimes, these are of a coral-red hue. It has been affirmed that the use, long unknown, of these horn-like jaws, is this: grasping a young and tender shoot of an ash or oak with the mandibles, the Stag-beetle unfolds its large wings, and flies rapidly round and round as if upon a pivot; the action soon cuts through the green bark, and the insect then feeds on the juices which exude. Our largest native Beetle (*L. Cervus*) is of this genus.

The timber-eaters, in fact, include by far the greatest number of Beetles, as well as those which are of largest size. In the dense tropical forests of America, Africa, and Asia, where the insect tribes

* Δυνάστης, *dynastes*, a lord.

† From Goliath, on account of their size.

‡ *Lucanus*, belonging to the dawn.

acquire a size and a magnificence unknown to us, the wood-eaters chiefly abound; having a commission to keep in check the mighty vegetation of those teeming regions by devouring the trees almost as soon as their noble heads have bowed to the storm. The magnificent genus *Buprestis** is one of these, whose species shine with the most gorgeous radiance; blue, purple, green, and crimson, alternately flash from their sculptured elytra, accompanied by a golden splendour that no colouring can imitate. The Long-horned Beetles, (*Prionus*,† *Cerambyx*,‡ &c.) distinguished by the great length, and often by the saw-like form of their *antennæ*, also live in the interior of trees, which their *larvæ* perforate in long winding channels. The former genus contains the very largest Beetles known, some of them, as the *P. Giganteus*, *P. Cervicornis*, &c., being of enormous size. The mandibles also are often of great length and thickness. A South American species, the Harlequin, (*P. Longimanus*,) is remarkable for the extreme length of the first legs, and the beautifully fantastic arrangement of colours, gray, red, and black, on the *elytra*.

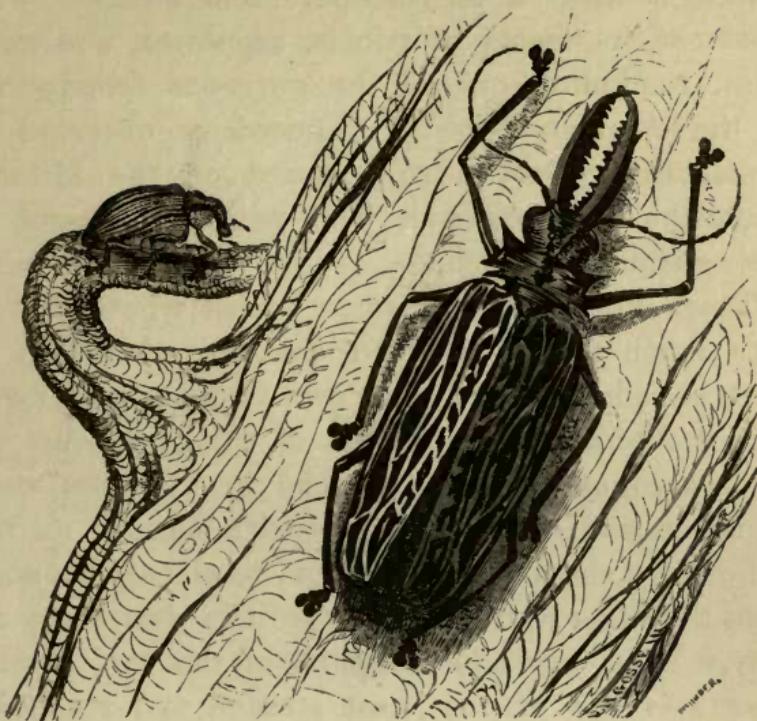
Of those Beetles whose *larvæ* derive their support from living plants, the Weevils, (*Curculio*,§) a numerous tribe, are the most remarkable. They are easily known by their plump, oval shape, and by their head being prolonged into a projecting snout

* The ancient name of a Beetle injurious to cattle.

† Πρίων, *prion*, a saw.

‡ Κέρας, *keras*, a horn.

§ Their ancient Latin name.



THE STAG-HORNED PRIONUS (*Prionus Cervicornis*), and DIAMOND-BEETLE (*Curculio Imperialis*).

on which the *antennæ* are carried, and on which, when not in use, they are folded close, by a singular angle in their middle. The *larvæ* feed on grain, seeds, nuts, fruits, &c., and are well known; and some eat into the buds of growing plants, and devour the heart and young pith. The *larva* of the *Calandra Palmarum* thus eats out the heart of the Cabbage Palm, and is itself eaten as a delicacy in the West Indies. To this genus belong those beautiful Insects known by the name of Diamond Beetles, (*Curculio Imperialis*,) whose *elytra*, when

placed beneath a microscope, seem studded with clustered fragments of rubies, sapphires, and emeralds, reminding one of the gorgeous descriptions of the Arabian Nights. Lacordaire observed in Brazil these Beetles so crowded on the Mimosa trees, that the branches bent with the weight of their glittering burden.

There appear to be some tribes whose diet is of a much more restricted character than that of those already noticed. Our own Glow-worm, (*Lampyris** *Noctiluca*,) an insect of much interest on other accounts, appears to feed in its *larva* state on snails, and to be furnished with a brush on the tail of very singular construction, to cleanse its body from the slime which attaches to it in destroying its prey.† The luminous property of this and similar Insects is one of the most strange and recondite subjects in natural history; its use is utterly unknown. The suggestion, frequently advanced, that its purpose is to guide the winged male to the apterous female in the darkness of the night, seems to be without sufficient foundation; for, besides the fact that other nocturnal Insects need no such aid as this, many other species of the genus have both sexes luminous, and both furnished with wings. The light of these foreign species, particularly the Fire-flies of tropical America, (*L. Corusca*, &c.,) far surpasses the feeble glimmer of our own; and when, as we have often seen, on looking from an eminence

* Λάμπω, *lampo*, to give light.

† Rennie, in Jour. Roy. Inst. Oct. 1830.

over a large field, the air is filled with myriads of Fire-flies sailing about in winding mazes, alternately emitting and concealing their light, the scene is one of indescribable beauty and radiance.

The pretty little Lady-birds, (*Coccinella*,*) those favourites of children, are confined in their food, both in the *larva* and perfect states, to the Plant-lice, (*Aphides*,) by devouring which they render us a valuable service. When handled, a yellow creamy fluid oozes from their bodies, which diffuses a rank odour. Other Insects, of widely different families, have a similar property, such as the Blister-beetles, (*Meloe*,†) to which tribe belongs the well-known and useful Spanish-fly, (*Cantharis*‡ *Vesicatorius*,) marked by their broad head and soft flexible *elytra*.

Thus are the innumerable hosts of these small creatures arranged, and marshalled, and kept in order by Him "who sitteth upon the circle of the earth," assigning to each its proper station, and feeding each with its proper food, so that there is no lack, and no interference with each other; thus, "He openeth His hand, and satisfieth the desire of **EVERY LIVING THING.**"

* Κόκκος, *kokkos*, scarlet colour.

† Μέλεος, *meleos*, dull, helpless (?).

‡ Κάνθαρος, *kantharos*, a beetle.

ORDER VI.—ORTHOPTERA.*

THESE Insects have much resemblance to the Beetles, but differ from them in having the body covered with a softer skin, the *elytra* membranous, and more evidently wing-like, not meeting in a straight line, but generally overlapping. The hind wings are folded like a fan. The *larva* and *pupa* resemble the perfect insect in form and every other respect, except in being destitute of wings, which however begin to appear in the *pupa*; this state is not motionless and inert, as in the Beetles, but active, feeding like the larva. They have been separated into two families, the Runners and the Leapers; to the former of which belong the Earwig, the Cockroach, and the Mantis; to the latter, the Cricket, the Grasshopper, and the Locust.

The Earwig (*Forficula*†) seems to be a connecting link between this Order and the Beetles, among which it was placed by Linnæus. The two curved pieces, forming a forceps, with which its body terminates, is a very strongly marked character. Our common species, named, by a foolish concession to vulgar prejudice, *F. Auricularia*, is too abundant to need much detail of its habits, these being but too well known to every lover of flowers, who has

* ὄρθος, *orthos*, straight, and πτερόν, *pteron*, a wing.

† *Forfex*, a pair of shears.

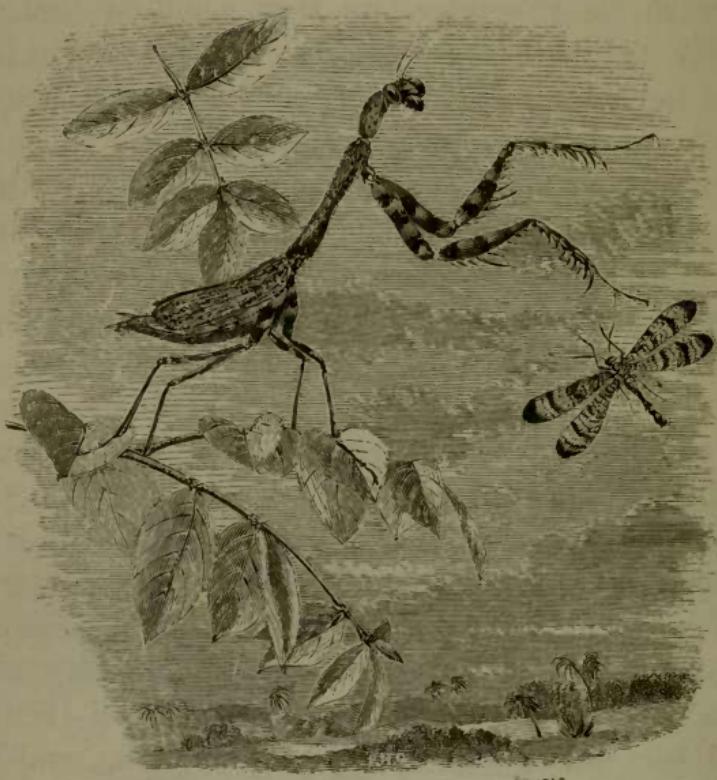
frequently to mourn the unsightly gnawing of cherished specimens. It is not wholly a vegetable feeder, however, for instances are recorded in which individuals, partners in captivity, have devoured each other. As a set-off against these unamiable traits in its character, we may mention that the female sits with great patience on her eggs, and rears her young with considerable care and tenderness, a thing very unusual in Insects.

Passing over the Cockroaches, (*Blatta*,*) which are still more troublesome and disagreeable than the preceding, we notice briefly the *Mantis*,† the most carnivorous of the Order. These are singularly formed creatures, of a lengthened shape, the thorax exceedingly long and slender, the eyes round and prominent, the fore-legs armed on the thigh and shank with long spines, which lock into each other when the leg is bent up. Their usual attitude of watching for prey is curious, and has given rise to familiar names in many countries, and a superstitious reverence for the insects, as if they were engaged in devotion. Rearing itself up on its four hind legs, the thorax nearly perpendicular, and the formidable fore-legs extended, the *Mantis* waits patient and motionless, except that its head turns from side to side, till some unfortunate Insect comes by, when it is seized with the swiftness of lightning by the closing of the leg, and held by the spines, and then devoured. They even fight with each other

* The Latin name of some destructive Insect.

† *Mártis, mantis*, a prophet.

with the most savage ferocity, and with great skill, guarding and cutting with the edge of the feet as with sabres, and sometimes at a stroke one cleaves the other through, or severs the head from the body,



THE AMERICAN MANTIS (*M. Carolina*).

when the vanquished is instantly devoured.* Some of this tribe have been called Walking Leaves,—the thorax, thighs, and body being furnished with broad margins, toothed at the edge, and coloured like a dry leaf.

* Rösel.

The Leaping Orthoptera have the thighs and shanks of the hindmost legs greatly developed, by the muscular power of which they are enabled to perform vast leaps. The males produce a ringing, chirping sound, which is caused by the rubbing of the thighs against the edges of the *elytra*, or by the friction of one *elytron* upon the other. No insect has a true voice. In the House Cricket (*Gryllus** *Domesticus*) this chirping is often annoying from its pertinacity, though some persons think it agreeable. The most remarkable of this family are the Migratory Locusts, (*Acrydium*,†) several species of which, agreeing in manners, but inhabiting different regions, appear to have been confounded. The immense armies which occasionally overrun Eastern countries, shadowing the sun; and the devastation they produce, eating up every green herb, and leaving the land as if a fire had passed over it, are familiar to all, from the frequent allusions to them in the Sacred Writers, as well as from the descriptions of Oriental travellers.‡

* Γρυλλίζω, *gryllizo*, to creak. † Ἀκρίς, *acris*, a locust.

‡ See Joel ii. 1—11.

ORDER VII.—HEMIPTERA.*

THE jaws which we have described in Eating Insects are here modified into a slender tube or sucker, with which those of this Order pierce the skin of animals or plants, and suck the juices for support. Most of them have the fore-part of the *elytra* opaque and leathery in texture, but the hinder extremity thin, membranous, and transparent, and this part generally overlaps the corresponding part of the opposite. Like the Insects of the preceding Order, they are active in all their stages.

The first family comprises the Bugs, included by Linnæus in his vast genus *Cimex*,† but now numerously divided.

Most of the species are found on trees and plants, not for the sake of their juices, but in pursuit of the insects that resort thither; as they are wholly carnivorous. Many of the foreign species attain a large size, and are marked with scarlet, black, and other colours in contrasts. They all diffuse a peculiar rank odour, and are insufferably nauseous if taken into the mouth, as the smaller kinds often are, in incautiously eating fruit. The Bed-bug (*C. Lectularius*) is, unfortunately, an example of the tribe, but too familiar, from its nocturnal attacks on man.

* "Hμισυς, hemisys, half, and πτερόν, pteron, a wing.

† Its Latin name.

Concealing itself by day in crevices from which it is difficult to dislodge it, it issues forth on the approach of darkness, and makes its insidious and foul attack on the unconscious sleeper, leaving tokens of its presence but too apparent in swollen, painful, and itching tumours, produced doubtless by the infusion of a poisonous fluid into the wounds made by the sucker. The Bed-bug differs from almost every other species in being destitute of both wings and elytra.

A South American insect of this Order has attained some celebrity as the Lantern-fly, (*Fulgora** *Lanternaria*,) remarkable for the front of the head being enlarged into a long, inflated, transparent snout. Mad. Merian gives an entertaining account of her surprise at opening in the dark a box, in which she had inclosed some of these insects; a glow of light at once streaming out that filled the room. Later observations have, however, thrown some discredit on this story, and modern naturalists are inclined to deny to the *Fulgora* any luminous property whatever.†

To this Order belong those minute but mischievous pests of the garden, the Plant-lice (*Aphis*). By wounding the leaves and tender shoots of plants, singular contortions are produced, the parts often closing up, so as to form a hollow space, the residence of a colony. An abundant fluid, of a sugary nature, exudes from them, which is exceedingly grateful to Ants. This fluid exudes in the form

* *Fulgeo*, to shine.

† See Proceed. of Zool. Soc. 1834, p. 19.

of limpid drops from the abdomen of the *Aphides*, and is the sweet, varnish-like substance called *honey-dew*, so often observed on the leaves of plants. Ants may generally be seen crowding to this repast, and they possess even the power and the intelligence to procure a more abundant supply by tickling the *Aphis* with the tips of their antennæ, on which a drop of the fluid is immediately yielded. It seems incontrovertible, indeed, that the Ants often imprison a number of *Aphides* to serve as domestic cattle by yielding their milk at home.

If we examine young branches of the Lime-tree in summer, we find many little excrescences of a skinny texture, about as large as half a sweet pea, adhering to the bark. On removing one, we see that it is merely a skin covering a little bunch of eggs. This skin is the female of a species of *Coccus*,* which, in laying her eggs, fixes them beneath her, so that at last they occupy nearly the same position as at first, save that the skin of the abdomen is now over instead of under them. The female never moves afterwards, her dead and dry body forming, as we have seen, a covering glued around them. She has no wings, but the male has two, laid flat on the body. From an American species (*C. Cacti*) we obtain the rich crimson dye, called cochineal, which, with a solution of tin, becomes scarlet. An Indian species produces shell-lac.

* Κόκκος, *kokkos*, scarlet.

ORDER VIII.—NEUROPTERA.*

IN most of these Insects the fore-wings are of the same texture as the others, naked, transparent, and filled with a multitude of veins or nervures, which cross each other, forming network of exquisite delicacy. Some, however, have the wings comparatively destitute of this character, and the fore ones are more firm in texture, concealing the others when at rest. All of them have jaws and mandibles, compound and simple eyes, but no sting or egg-tube. Most of them are water insects in their first stages, and carnivorous in all.

The Dragon-flies (*Libellula*) occupy the most prominent place in this Order. Their light and graceful form, their long and lustrous wings, their agility of movement, and their beautiful colours cannot fail to attract attention; they are, however, as sanguinary as they are beautiful. The *larva* and *pupa*, scarcely distinguishable from each other, live in fresh waters, especially in still ponds: they have a broad body, of a dirty brown hue, and six long sprawling legs, which give them somewhat the appearance of Spiders. They swim or glide through the water by a most singular apparatus. The abdomen is in a great measure hollow, but furnished with a piston accurately fitting it, which can be considerably with-

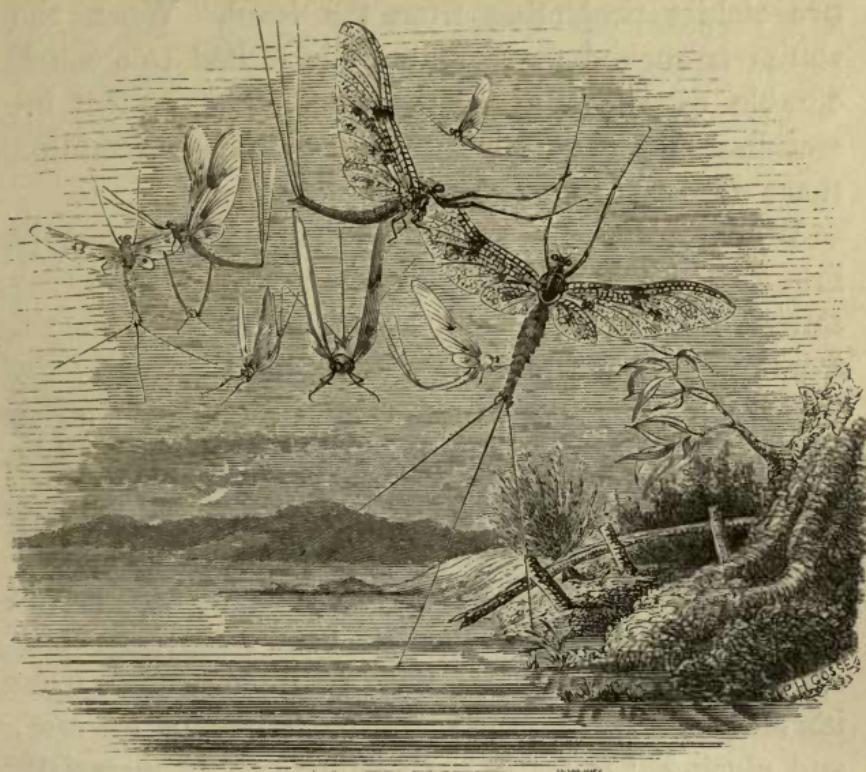
* Νεῦρον, *neuron*, a nerve, and πτερόν, *pteron*, a wing.

drawn. When this is retracted, the cavity becomes filled with water, which by the thrusting down of the piston to the extremity is forcibly expelled as from a syringe; this stream, acting on the surrounding fluid, communicates an impulse to the Insect which shoots it forward several inches. This may be readily witnessed, as the *larræ* are procured in any pool in spring. The mouth is a most formidable apparatus for seizing and tearing prey; the whole face is composed of a long flat kind of mask, ending in a rounded point, and divided in the middle by serratures, like the teeth of a gin, which fit into each other. These valves it throws open, and darts to a great length by means of a double fold, on the approach of prey, to seize it and carry it to the mouth which is concealed within, the serrated teeth holding it firmly while it is being devoured.

The *pupa*, when fully matured, crawls out of water on some tree or herb, where it remains until the sun dries its skin; this then splits down the thorax, and the perfect insect comes out in its beauty, leaving the empty pupa-case still clinging to the stalk. The wings are at first very short, thick, and wrinkled; but, by the circulation of the fluids through the nerves, they rapidly expand to their full size and form, become transparent, and finally stiff and firm. Then away the *Demoiselle* flies, to hawk to and fro over the water she has just left, in pursuit of the gnats and flies that throng the air. On catching an insect, she invariably alights to eat it.

The Day-flies, (*Ephemera*,*) noted for their brief

* Ἔφημερος, *ephemeros*, enduring for a day.



DAY-FLIES (*Ephemera Vulgata*), in sunset-dance.

existence in the perfect state, in some species not exceeding four hours, belong to this Order, as does also the Ant-lion, (*Myrmeleon,**) whose *larva* excavates a funnel in sand, at the bottom of which it patiently watches, till some passing ant incautiously venturing too near the edge, loses her precarious footing, and is carried with the slippery sand to the bottom of the den. It is instantly seized by the rapacious Ant-lion, and its juices sucked out through two immense curved and tubular jaws, resembling

* Μύρμηξ, *myrmex*, an ant, and λέων, *leon*, a lion.

two sickles projecting from the head. When the victim is sucked dry, the body is jerked to a considerable distance out of the den. The perfect insect has large transparent wings, much resembling those of some Dragon-flies.

Whoever has for a few moments looked closely into a shallow pool, must have noticed many moving things, like bits of stick, about an inch in length, from one end of which protrude a head and six legs. These are the tubes of the Caddis-worms, the *larvæ* of the genus *Phryganea*,* well known to anglers. The worm itself constructs the tube for the protection of its soft body, by collecting minute matters, varying in different species, such as bits of twigs, straw, bark, shells, stones, &c., and fastening them each to each around its body with silk spun from its mouth. By carefully depriving one of its case, and placing it in water with a selection of materials, we have witnessed the construction of a new one with great pleasure. The head, thorax, and legs are continually thrust out in search of prey, as the *larvæ* are very voracious. When full-grown, the insect closes the mouth of its tube with a network of silk, and changes to a *pupa*, which at the appointed time crawls out of the case and comes upon the land, where it perfects its condition in the manner of the Dragon-fly. The fly resembles a Moth, having brown wings, the upper concealing the lower, and placed, when at rest, like the roof of a house: it flits to and fro over water, chiefly in the evening.

* Φρύγανος, *phryganon*, a dry stick.

But none of this Order are so celebrated as the White-ants (*Termes**) of tropical Africa and Asia. The powers of destruction with which these insects are endowed are almost beyond belief. Nothing is secure from their ravages but glass; even metals they incase and corrode with their peculiar secretions, and all kinds of furniture, clothing, books, and papers, are devoured with incredible rapacity. They will frequently pierce the floor of a house, into a trunk, consume every thing in it in one night, and almost fill it with strong galleries and walls of a kind of mortar. Even houses are sometimes destroyed by them, the wood-work of the walls being entirely eaten up. In the woods they destroy fallen trees in a very brief space, leaving only the thin hollow bark, which retains indeed the appearance of a large trunk, but on being touched drops to dust. Some species build conical houses, ten or twelve feet high, of the mortar above-mentioned; these are intersected by numberless covered ways, or galleries, leading to the centre. A great number of individuals live in society in these dwellings, composed of four kinds; the males, the females, the neuters, or soldiers, and the *larvæ*, or labourers. The neuters are not *pupæ*, as has been supposed. In these particulars we see a close affinity with the true Ants, Bees, &c., among the *Hymenoptera*. A very little Insect, sometimes called a Woodlouse, (*T. Pulsatoria*,) which we often see nimbly running in old drawers, or among papers, belongs to this genus.

* The Latin name of some insect.

ORDER IX.—HYMENOPTERA.*

LIKE the last Order, the *Hymenoptera* have four naked transparent wings; but the fore wings are always the largest, and so linked by the edge to the hind pair as to look like a single pair; the nervures are very few, and not netted; the abdomen is furnished with a tube, which in some species serves merely for the deposition of the eggs; in others it is connected with a poison-bag, and forms a venomous sting. They have jaws and mandibles, but several genera have the former modified into a tubular fleshy sucker, with which the nectar of flowers is sucked or licked up.

Their *larvæ* and *pupæ* differ greatly. In some, the former take the appearance of many-footed caterpillars, feeding on leaves, and the latter are inclosed in a tough leathery cocoon; but in most cases the *larva* is a white maggot without feet, and the *pupa* has its limbs folded down, as in that of a Beetle. The food of the *Hymenoptera* varies greatly, and is often connected with singular habits and instincts, some of which we shall notice as we proceed.

Of those which have a projecting egg-tube instead of a poisonous sting, none are more remarkable than

* ῥυὴν, *hymen*, membrane, and πτερὸν, *pteron*, a wing.

the Cuckoo-flies, the great genus *Ichneumon** of Linnæus. Their instincts constitute them one of the greatest auxiliaries to man, as they keep down to an amazing extent the increase of other Insects, which would else soon produce famine by devouring the labours of agriculture. They do not, however, attack the perfect insects, but the *larvæ*; and chiefly those of Butterflies and Moths. The female *Ichneumon*, which may often be seen peeping about bushes in search of her prey, pierces the flesh of a caterpillar with her slender egg-tube, and deposits there an egg; occasionally, this is repeated many times, and many eggs are lodged within the body. The caterpillar seems to experience no inconvenience except the momentary pain of the puncture, but goes on feeding as before. In process of time, however, the egg hatches, and the grub finds abundant food in the fat of the caterpillar, on which it feeds, without touching the vital parts, until it is full grown. The caterpillar is generally too much enfeebled to undergo its change into *pupa*, but dies; the grub either perfecting its condition within the body, and emerging a perfect fly, or else, as in the case of the species (*Microgaster*† *Glomeratus*) that inhabits in numbers the caterpillar of the White Cabbage Butterfly, (*Pontia Brassicæ*), eating a hole through the skin, and spinning its little yellow cocoon with those of its fellows about the

* The Greek name of an animal that destroyed the Crocodile in the egg.

† *Μικρός*, mikros, little, and *γαστὴρ*, gaster, the belly.

dead or dying body. Sometimes, however, the caterpillar becomes a chrysalis before the *Ichneumon* is perfected.

Those *Hymenoptera* which are furnished with a formidable weapon of offence in a sharp, slender sting, concealed within the body, but protruded at will, and connected with a reservoir of poison, contain many tribes of high interest. Many of them live in societies, and in these, besides the males and females, there is often a third class of individuals by far the most numerous, called neuters, in which the sex is not developed. To do anything like justice, however, to the economy of the Hive-bees, (*Apis*,*) Humble-bees, (*Bombus*,*) Ants, (*Formica*,*) and Wasps, (*Vespa*,*) would vastly exceed our space; we are therefore compelled to content ourselves with a mere mention of them, and a slight notice of others which are less known.

As the Spiders seem to make winged insects their natural prey, so there are some Flies which, by an equitable application of the *lex talionis*, live only upon Spiders. They have been called Burrowing Wasps, and belong to the genus *Sphex*† of Linnaeus. Many of them dig holes in the earth with their feet, in which they lay their eggs, enclosing with them one or more Spiders, which they have so stung as to paralyze, but not to kill them; the young grub when hatched feeds upon the bodies of the yet living Spiders. We once witnessed with

* Latin names of these insects.

† Σφῆξ, *sphex*, a wasp.

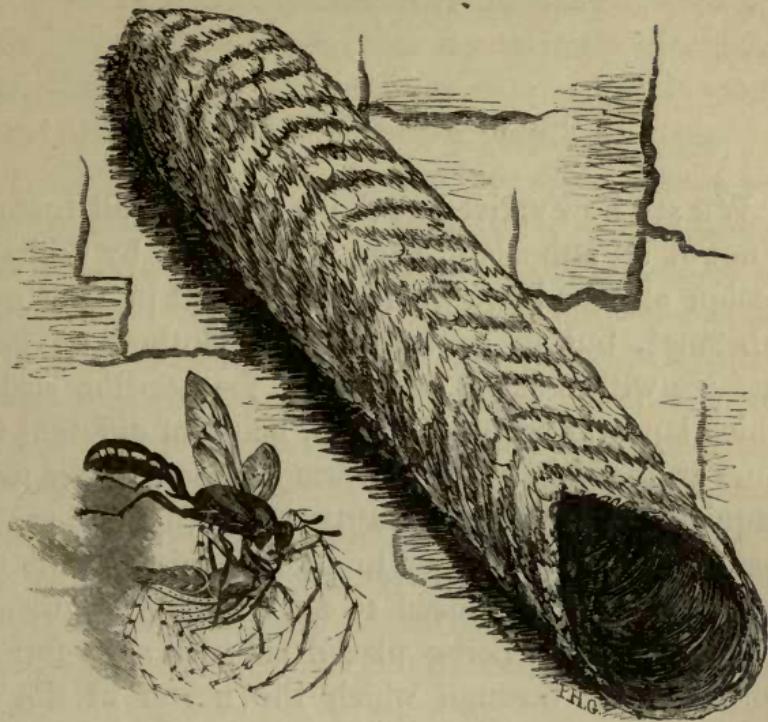
great interest the efforts of one of these Burrowers (*Pompilus** *Viatica*) to immure a heavy Spider. A hole, about as large as a quill, was made in a dusty path through a field, around which was the earth that had been dug out ; within a few inches lay a large, round-bellied, dusky Spider, (*Lycosa*,) motionless, which the *Pompilus* was trying to drag to the hole : it was up hill, however, and was no easy matter. She caught hold of one of the thighs of the Spider with her jaws, and with her tail towards the hole began to tug ; but the dust continually gave way under her feet, and she could not make much progress. She would tug for a few seconds, then let go, and run to the hole, descending head foremost, but immediately coming out as she went in, head downward ; once, however, she turned in the hole. Sometimes, by sudden exertions, she succeeded in dragging the Spider a little way, and once, as she was getting along finely, and had him nearly half up the hill, the round Spider suddenly rolled down, dragging the *Sphex* completely over in a somerset. At length we took pity on her, and while she was in the hole, moved the Spider to a more favourable position. On coming out, she went to the old spot, but, finding no Spider, seemed quite bewildered, wandering to and fro, and now and then tracing the way to and from the hole ; soon, however, she found the Spider again, and at length succeeded in dragging him to the mouth of the hole. Previously to this, we had observed her dig with

* Πομπίλος, *pompilos*, the Greek name of a fish.

the fore feet for a few seconds at the mouth of the hole, as if conscious that it needed enlarging. Having got the prey up to the mouth, she descended, tail foremost, and tried to draw it down, grasping the thigh close to the thorax; the Spider was, however, too large to go in this way, and so she instantly let go, and seized him by the extremity of the abdomen, where she had not touched him before, and drew him down. Even thus, it was a tight fit, but at length he disappeared within the hole; and, as the *Sphex* did not reappear for some time, we left the place. All the time she was dragging him, her wings were shut, but in constant motion, flirting up and down.

An American genus, (*Pelopaeus*,*) allied to the preceding, is called the Dauber, from its singular habit of placing its nest of mud against the walls and ceiling in the interior of houses. When finished, these nests look like handfuls of clay, which have been thrown up at random, and adhered; but inwardly they contain very smooth and regular cells, each containing a grub, and a dozen or more of Spiders. The construction of these nests, which we have observed with great minuteness, is performed by the Dauber bringing little pellets of clay in her mouth, about as large as peas, one after another, which she spreads and arranges with her jaws; previously to closing up each, she lays an egg in the bottom, and places over it, as we have said above, from twelve to eighteen Spiders, not

* Πελας, *pelas*, near, and οπαιον, *opaion*, a chimney.



THE DAUBER (*Pelopaeus* —— ?), carrying a Spider (*Tetragnatha**) to its nest.

killed, but rendered helpless. The grub spends its life in this dark and solitary prison, and when full grown, having eaten the abdomens of all or nearly all the Spiders, forms an oval cocoon of a brittle shelly substance, and goes into *pupa*; the perfect fly when evolved gnaws its way through the mud walls with its strong jaws, and for the first time beholds the light.

* *Tetρα*, tetra, four, and *γνάθος*, *gnathos*, a jaw.

ORDER X.—LEPIDOPTERA.*

WE are now arrived at the loveliest of all Insects, if not of all animals. They are marked by the possession of four large wings, transparent in their own substance, but in general thickly clothed on both surfaces with a series of minute feather-like scales, which lap over each other, and, being of different colours arranged in patterns, form a mosaic of the most exquisite delicacy and beauty. The upper jaws or mandibles are no longer to be recognised; but the lower jaws are produced to an extreme length and slenderness, and being placed side by side, form a double tube, through which the nectar of flowers is pumped up, but which, when not in use, is rolled up in a spire of very small compass. The *larvæ* are commonly known by the name of caterpillars; they have a soft cylindrical body, three pairs of horny feet, and from four to ten false feet, or clingers, on the hind parts of the body, each composed of a circle of minute hooks on a fleshy projection. In most cases they feed on the leaves of plants; a few devour the wood of living trees, in which they burrow, and some eat wool, fur, skin, fat, and wax. The *pupa*, called a chrysalis, is motionless, except an occasional slight wriggling of the abdomen, having the limbs folded down and covered

* Λεπίς, *lepis*, a scale, and πτερόν, *pteron*, a wing.

with one common skin ; their position and shape, however, can in most cases be traced. Butterflies pass their *pupa* state without any external protection ; most of them being either suspended loosely by the tail in a perpendicular position from a little button of silk, or having, in addition to this support, a girdle of silk passing round the body, fastened on each side, on which the chrysalis hangs horizontally or obliquely. Many Moths are protected in this state by an oval cocoon, more or less dense, composed of silk spun by the caterpillar just before its change, but a large number undergo their change in the earth, destitute of any protection.

The *Lepidoptera* are arranged in three great families, named from the season of their chief activity.

FAM. I.—DIURNA,* BUTTERFLIES.

In this family we find the greatest elegance of form and richness of colouring, especially in those magnificent species which inhabit the tropics. The wings, almost invariably, are *erected* when the Insect rests, so that the upper surfaces of the opposite pairs come in contact with each other. In most genera, the antennæ are long, slender, and, except in those which form the connecting link with the other families, terminated by a club.

The genus *Papilio*,† restricted as it now is, is

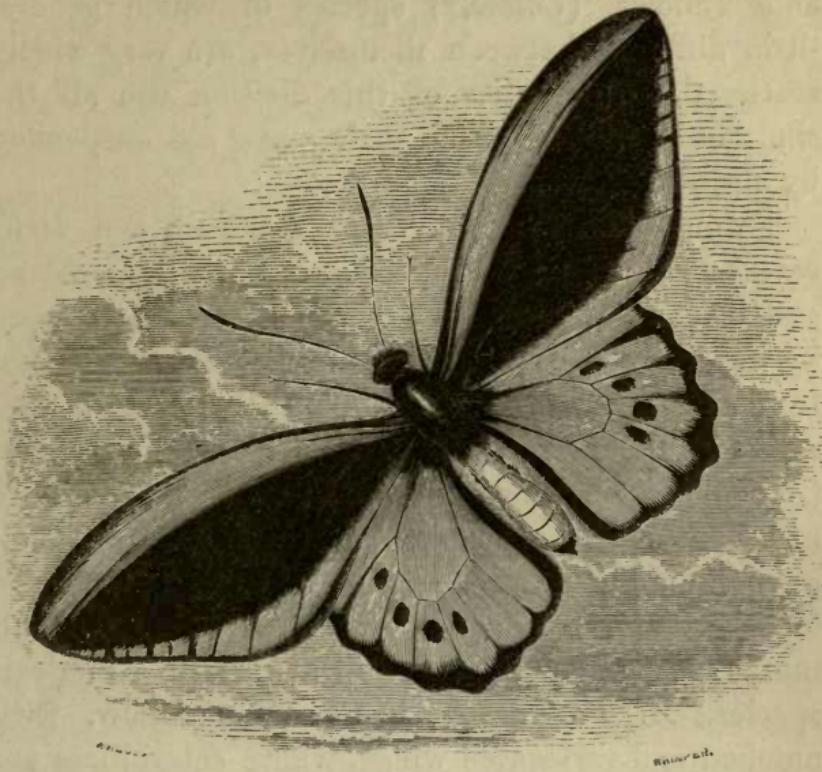
* *Diurnus*, belonging to the day.

† The Latin name for a butterfly.



THE TIGER SWALLOWTAIL (*Papilio Turnus*), and THE ADMIRABLE
(*Vanessa Atalanta*).

exceedingly rich in species, the greater number of which have the under wings furnished with a projection, which has given them the familiar name of Swallowtails; but some are destitute of this distinction. The genus is chiefly abundant in the hot regions of South America and the Asiatic Islands; but we have one species in England, *P. Machaon*, whose wings are yellow, banded with black. It is scarce, but its handsome caterpillar, green with black rings spotted with red, is occasionally found feeding



THE PRIAM BUTTERFLY (*Papilio Priamus*).

on fennel. The largest, and one of the most beautiful, of this division is the *P. Priamus*, from the Eastern Archipelago, whose wings, splendidly coloured with rich green and deep black, measure seven or eight inches in extent.

The colours of this large division are very various; but perhaps black and yellow may be the most frequent tints, often arranged in transverse bands. Allied to them are our common Whites (*Pieris**)

* Πιερίδες, *Pierides*, the Muses.

and Yellows, (*Colias,**) species of which genera, little differing between themselves, are very widely scattered. Butterflies of this division use all the six feet in walking, and their *pupæ* are suspended by a girdle, as well as by a button.

Through the foreign genera *Danais†* and *Heliconius,‡* whose prevailing colours are orange-tawny and black, and the latter of which is distinguished by the lengthened oval form of the fore wings, and by being almost destitute of feathery scales, we arrive at those pretty Butterflies called Fritillaries, (*Argynnis,§ &c.,*) marked with black or orange, more or less tessellated or chequered, and frequently ornamented on the inferior surface by spots and dashes of bright silver, as in our own *A. Aglaia,||* and still more remarkably in a beautiful North American species, *A. Vanilleæ*. The *Vanessæ* follow, with notched and variegated wings, whose caterpillars are armed with barbed spines. We have several native species of this genus, such as the Admirable, (*V. Atalanta,*) banded with scarlet on velvet black; the beautiful Peacock, (*V. Io,*) with its rich eye-spots, and the common Tortoiseshells, (*V. Urticæ, &c.*) A large and richly-coloured tribe is allied to this, (*Nymphalis,¶*) whose wings are often adorned with a rich purple gloss, visible only in certain lights.

* The Greek name of a fish. † An ancient Greek proper name.

‡ Belonging to the Muses, Ἑλικονιάδες, *Heliconiades*.

§ Ἀργυρός, *argyros*, silver.

|| One of the Graces in the Greek mythology.

¶ Belonging to the Nymphs.

The species are chiefly foreign, but are represented in England by the famed Purple Emperor (*N. Iris*). South America produces some very large species, (*Morpho*,*) the upper surface of which is of a silvery blue so dazzling in its lustre, that the eye can scarcely bear to look on it in the sun. The under side of these is usually sober brown, adorned with large eye-spots. Contrasting with these, we find the wide-spread and numerous Browns (*Satyrus*†) of our woods and meadows, whose dull hues show little variety. In this large division, the first pair of legs are short, hairy, and not used for walking; the *pupæ* are suspended from the tail alone.

Another division includes the beautiful little Coppers (*Lycæna*‡) and Blues, (*Polyommatus*,§) the former marked by fiery red, with a metallic glow; the latter by an equally brilliant azure. And the last section contains some species, often called Skippers, (*Hesperia*,||) of heavy form, small size, and dull colours, which in the form of the antennæ and other points approach the Hawkmoths. But some fine foreign Butterflies (*Urania*¶) of this division, while they are evidently allied to the Moths in important respects, show in their large size, the form of their wings, which are *tailed*, their bright colours, and the arrangement of these in transverse bands, a

* Μορφή, *morphe*, beauty.

† A fabled wood-demon.

‡ Λύκη, *lyke*, light.

§ Πολὺς, *polys*, many, and ὄμματα, *ommatia*, eyes.

|| Ἑσπερός, *hesperos*, evening.

¶ One of the Muses.

marked affinity with the true *Papiliones* with which we began.*

FAM. II.—CREPUSCULARIA,† HAWK-MOTHS.

The Insects of this division, very few of which are ever seen abroad during daylight, never erect their wings. The upper pair are linked to the lower by a curious curved spine, which, proceeding from the base of the latter, passes through a sort of loop on the under side of the former, and thus retains them in their place. The antennæ gradually

* We wonder that no one has tried to naturalize some of those splendid foreign Butterflies which inhabit climates similar to our own, and whose caterpillars feed on plants which grow naturally in both localities ; and there are many such, especially in North America, such as the beautiful *P. Turnus* and *Asterius*, the former of which feeds in the larva state on the willow and ash, and the latter on the parsnip and other *umbelliferæ*. Both of these are common even so far north as Newfoundland. It might doubtless be easily effected by collecting the caterpillars in their own country, and allowing them to go into chrysalis, in which state they might be transported during the winter, and be evolved here in spring. We have had a specimen of *P. Asterius* produced here from a chrysalis which we had brought from North America ; and we have seen in the collection of Mr. Loddiges, a specimen of *Coronis* — ?, a noble Brazilian species, which that gentleman informed us had been produced in his conservatory at Hackney, having been probably introduced in the earth of some imported plant. We see no reason indeed why the magnificent Lepidoptera even of the tropics might not be reared in our conservatories and stove-houses, as readily as the Palms and Orchideæ of the same regions. Whatever plant might be the food of the larva, provided it were known, might surely be obtained in England in the present state of botanical science.

† *Crepusculum*, the twilight.

thicken from the base, and are frequently angular and rough. The caterpillars have always sixteen feet, are generally destitute of hair, and often, especially in the larger kinds, have a stiff projection like a horn on the hinder part of the body. These have the habit of raising the fore half of their bodies with the head bent down, sitting for a long time in a posture resembling that of the Egyptian



THE UNICORN HAWK-MOTH (*Sphinx Convolvuli*).

Sphinx, after which the family was named by Linnaeus. The *pupæ* are smooth, that is, not angular like those of Butterflies; but some have the sucker, which in this Family is very long, enclosed in a separate skin or case, and projecting from the head.

They generally pass this state under ground, but a few are enclosed in a cocoon.

The larger species belonging to the genus *Sphinx* are often beautifully, though somewhat soberly, coloured, the tints being softened and blended into each other. In their manners they very much resemble the Humming-birds, poising themselves on the wing in front of a tubular flower, and probing it with their long sucker, while their wings, visible only like a dim cloud on each side from the rapidity of their vibration, make a loud ringing hum. Thus they go from flower to flower, if undisturbed, visiting many in succession ; but, if alarmed, they are gone like a thought. The largest European species is the Death's-head, (*Acherontia Atropos*,*) marked with yellow and various shades of grey, with a spot, having a rude resemblance to a skull, on the *thorax*. It measures more than five inches in extent. This fine Insect has been the subject of an absurd superstitious dread, partly from its ominous badge, and partly because it has the faculty of producing a shrill creak, like the cry of a mouse. How this sound is uttered is still a matter of much dispute.

Some genera, composed for the most part of small species, have wings almost destitute of scales, and therefore transparent. From this circumstance, from their form, and from the arrangement of their colours, they often bear so close a resemblance to certain Hymenopterous flies, as scarcely to be identi-

* Ἀχέρων, Acheron, a fabled river in Hell ; and *Atropos*, one of the Parcae.

fied. The *larvæ* of these inhabit the interior of the stems of certain plants, eating the pith and heart-wood; they are usually whitish, and destitute of a horn. They pass the *pupa* state in the same situations.

FAM. III.—NOCTURNA,* MOTHS.

In form and general appearance, this family approaches the preceding, but the *antennæ* taper from the base to the point; the wings are linked together as in the former; they are rarely erected, being usually extended horizontally, or inclined, roof-like, on each side of the body. A few, it is true, are active during daylight, especially in the afternoon, but the great majority appear abroad only during the night; and the sober colours, grey and brown, in which most of them are arrayed, show the obscurity of the season for which they were intended. The males of many genera have the *antennæ* set with parallel rows of bristles, like the teeth of a comb, or the beards of a feather. The sucker is sometimes long, but in other cases it is so short as scarcely to be found; the species do not, usually, feed on the wing. The caterpillars vary much in appearance, some being smooth, others clothed with hair, either plain, or arranged in tufts or brushes. Some live between the membranes of a leaf, eating out the green pulp, the traces of which may be readily seen in the winding white lines on the leaf

* *Nocturnus*, belonging to the night.

of the bramble; others form to themselves little tents or cases, like the Caddis-worms; others again roll up leaves, or bind several together with silk for a habitation; others live in society in an enormous web; and others again dwell beneath the surface of water. One large tribe, to which the useful Silkworm belongs, (*Bombyx* Mori*,) spin an oval case of silk around themselves, in which they become pupæ. A very great number of the species, however, change beneath the earth.



THE ATLAS MOTH (*Saturnia Atlas*).

* Its ancient Greek and Latin name.

Among the largest and finest species may be reckoned the great Atlas Moth (*Saturnia** *Atlas*) of China, whose expanded wings measure nearly a foot in diameter. It is elegantly marked with various shades of reddish brown, with a large transparent spot in the centre of each wing.

Among the smallest are those enemies to good housewifery, the Clothes Moths, (*Tinea*,†) which destroy cloth, fur, &c., not only by eating the fibres, but by cropping them to be woven into tubes for their own residence. To this tribe belong some of extreme minuteness, but adorned with metallic brilliancy, like burnished brass or silver. One of the most singular forms is that assigned to a small genus named Plume Moths (*Pterophorus*‡). Each wing is here divided almost to the base into two or three slender fingers, broadly fringed on both edges, so that the Moth appears to have a fan of five or six feathers on each side instead of wings. The Six-cleft Plume Moth, (*P. Hexadactylus*,§) a little creature of remarkable elegance, may often be observed resting on our garden walls in the latter part of summer.

* A name of Juno, to whom the peacock was sacred : applied to these Moths on account of the beautiful eye-spots frequent in this genus.

† Their Latin name.

‡ Πτερόν, *pteron*, a wing, and φέρω, *phero*, to bear.

§ Ἑξ, *hex*, six, and δάκτυλος, *daktylos*, a finger.

ORDER XI.—STREPSIPTERA.*

THIS is a group of singular Insects of very small size, which in their early stages inhabit the bodies of some Bees and Wasps, coming forth when perfected from between the rings of the abdomen. They have two large wings, forming each one fourth of a circle, and a pair of very small twisted organs before them, like minute elytra. The antennæ are singularly branched; the eyes large, with few facets. They have been but recently made known.

The following observations were recorded by Mr. Dale, of one (*Stylops* † *Dalii*) which he caught flying over a hedge: “ It looked milkwhite on the wing, with a jet-black body, and totally unlike anything else: it flew with an undulating or vacillating motion amongst the young shoots, and I could not catch it till it settled on one, when it ran up and down, its wings in motion, and making a considerable buzz or hum: it twisted about its tail, and turned it up like a *Staphylinus*. I put it under a glass, and placed it in the sun; it became quite furious in its confinement, and never ceased running about for two hours.” ‡

* Στρέφω, *strepho*, to twist, and πτερόν, *pteron*, a wing.

† Στύλος, *stylos*, a column, and ὄψ, *ops*, the eye.

‡ Brit. Entom. fol. 226.

ORDER XII.—DIPTERA.*

THE great character of this Order is easily recognised; it is, that they have but a single pair of wings, but in the place of the second pair there is, on each side, a little slender stalk, bearing a club-shaped head; these are called *halteres*,† or poisers, though their real use seems yet uncertain; they are certainly essential to flight. The mouth takes the form of a sucker, terminating in fleshy lips, or enclosing a sharp piercing lancet. These insects vary greatly in their transformations. The *larvæ* are always without feet; some inhabit water, others the wood of trees, others the flesh or the intestines of Mammalia. Those which have a scaly head, change either to an active *pupa*, as in the Gnats, or to one covered, but in which the limbs are visible, as the Crane-flies; but such as have the head soft and varying, become *pupæ* without throwing off the *larva* skin, which, drying, becomes an oval cocoon, from which the *pupa* within separates, and in due time comes forth, bursting off the top of the case. Such is the transformation of the Flies.

Few Insects are more annoying than the common Gnat, (*Culex*,‡) and few are more interesting in their habits. The female Gnat, alighting on the

* Δύο, duo, two, and πτερόν, *pteron*, a wing.

† *Halter*, a plummet.

‡ Its Latin name.

surface of standing water, lays an oblong egg perpendicularly in the angle formed by the crossing of her hind legs. Other eggs are placed parallel to and touching this, until a little oval boat of attached eggs is formed, which floats on the surface. The grubs are hatched in the form of little fishes with great heads, which wriggle to and fro, frequently coming up to breathe through a tube placed on one side of the tail. In due time a *pupa* is produced, somewhat resembling a lobster in form, very nimble in its movements, swimming by means of a fin at the tail, which is bent under the body. It now breathes by two projections on the *thorax*. By and by, it comes to the surface for the last time, the skin splits, and the perfect Gnat is evolved from its precarious bark.

The vast tribe of House-flies, Blow-flies, &c., (*Musca*,*) some of which are injurious to us, by attacking our provisions, the long-legged Crane-flies, (*Tipula*,*) and the Whame-flies, (*Tabanus*,*) and Bot-flies (*Oestrus*†) that infest our cattle, belong to this Order.

* Latin names of Insects.

† Οἰστρός, *oistros*, their Greek name.

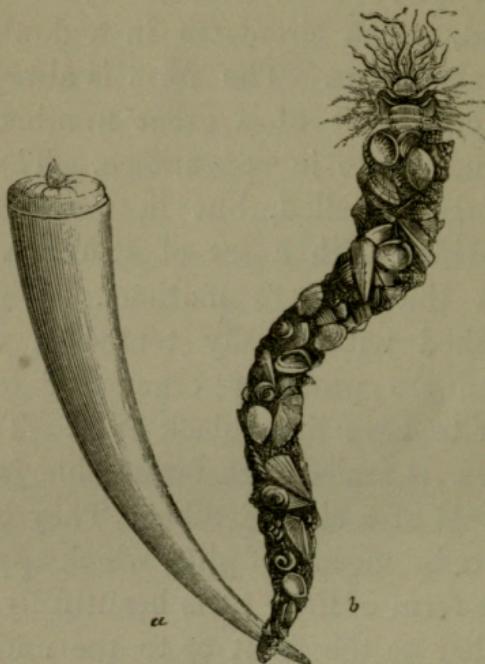
CLASS IV.—ANNELIDA.*

THIS Class, of which the Earth-worm forms a familiar example, is distinguished by the possession of red blood, which circulates in a double system of arteries and veins. The form is always lengthened, and composed of a great number of rings, generally much alike in appearance. There are no limbs properly so called, but in most cases, each ring is provided with a set of stiff bristles, *setæ*, which assist the animal's motions. The head is often furnished with fleshy tentacles, varying in shape, which are probably organs of touch: and some appear to have little black eyes. The mouth, in some cases, is armed with formidable jaws, but in others consists of a simple tube. They breathe for the most part by means of gills, which appear externally, in the form of little tufts beautifully branched, attached either to the front or to the middle of the body: but some breathe, either by means of the whole surface of the skin, or by little cavities in the body. With the exception of the Earth-worms, all the species inhabit the waters. There are three Orders.

* *Annellus*, a little ring.

ORDER I.—TUBICOLA.*

IN these, the gill-tufts are attached to the forepart of the body, a necessary arrangement, as the body is enclosed in a tube, open only at the extremity.

TUBICOLA.—(*Dentalium Entalis*, and *Terebella Medusa*.)

This tube, which in some cases resembles the shells of the *Mollusca*, among which, some (as the genus *Dentalium*† or Elephant's Tusk) have been placed,‡ is

* *Tuba*, a tube, and *colo*, to inhabit.

+ *Dens*, a tooth.

‡ Since the above was in type, the author has been informed that *Dentalium* has been proved to be a true *Gasteropod Mollusk*,—a fact of which he was not previously aware.

formed by an exudation from the skin, of a glutinous nature, which either hardens into a simple horny covering, or else, as is more frequent, becomes a sort of shell by the adhesion of grains of sand, bits of shells, and other matters to its surface. The *Terebella Conchilega*,* for example, unfolding the coils of its body, extends its large tentacles in every direction, in search of fragments of shells. These it drags to its head, fastens them in a sort of ring or collar, by means of a gummy matter, and, by lengthening this, forms a tube prettily studded with little shells. The similarity of this process to that of the Caddis-worm, (*Phryganea*,) is remarkable and interesting.

Many of the Order have, to a greater or less extent, the power of boring, not only into sand, but into solid substances, such as wood, sponges, corals, and even rocks ; they feed on very small animals, which they catch with their tentacles.

* Diminutive of *Terebra*, a little borer ; *κόγχη*, konche, a shell, and *λέγω*, lego, to collect.

ORDER II.—DORSIBRANCHIATA.*

THE branching gill-tufts are here placed on the middle portion of the body, but in some they are attached to every ring. A very few inhabit tubes, but the greater number are free, and burrow in mud, or swim in the ocean. For these purposes, each ring is usually furnished with little packets of moveable bristles, which act as feet or oars.

One of the most common, as well as most useful of the whole Class, is an animal of this Order, the Sand-worm (*Arenicola† Piscatorum*). It is exceedingly abundant on sandy shores, and is eagerly sought and used by the fishermen as bait. In Dorsetshire it is called Lug. It is of a reddish colour; and the gill-tufts, which form a double row of little bunches, down the middle part of the body, are of a beautiful crimson hue, from the blood which abundantly circulates in them. It bores rapidly in the sand by means of its conical head, which can be lengthened or shortened at pleasure; and, as it moves on, the sides of the treacherous passage are prevented from closing up again, by a secretion from the body of the animal, which unites the particles of sand into a kind of wall, and which as it advances

* *Dorsum*, the back, and *branchiae*, gills.

† *Arena*, sand, and *colo*, to inhabit.

is left behind; thus resembling the brickwork of a tunnel.

It is not to such animals as these that we should look for much splendour of colouring; and yet there is a creature belonging to this Order, which will vie with the most richly adorned bird or beetle. It is the Sea-mouse (*Halithea** *Aculeata*), whose form is much shorter than that of most Annelidans, approaching even to an oval. From the sides project bunches of flexible spines or bristles, of a splendid golden hue, on which play all the changing tints of the rainbow: and which, as Cuvier observes, "are not inferior in beauty to the plumage of the Humming-bird, or to the lustre of the richest gems." Each of these bristles, moreover, is seen under the microscope to be a barbed dart or harpoon, the extremity being cut into several teeth pointing backward, affording truly formidable *chevaux de frise*, for its protection against violence. But as these spines, as usual in animals of this Class, are, when not in use, drawn back, and sheathed as it were in the body, an additional provision is necessary. It is obvious that barbed spines, such as these, imbedded in the flesh of the animal, would be exceedingly painful, as every movement of the body would force some of the points into the surrounding parts, and laceration and injury would be the infallible result. To prevent this, each individual spine is provided with a smooth horny sheath,

* "Αλς, *hals*, the sea, and θεα, *thea*, a goddess.

composed of two blades, between which it is lodged, which closing upon it when drawn inwards, effectually protect the flesh from injury.

The insane efforts of some French philosophers to shut out all recognition of the creating God, even from a contemplation of the works of His own hand, need no more triumphant a refutation than an appeal to this worm. Was a structure so elaborate, a mechanism so beautiful, produced by “the power of attraction acting on irritable atoms?” or did “the penetrating force of expansive fluids” form these exquisite organs of progression and defence, point their extremities, and barb their edges? or was it the “stimulus arising from a consciousness of want,” that enclosed them in these smooth elastic sheaths? “Ask now the beasts, and they shall teach thee; and the fowls of the air, and they shall tell thee: or speak to the earth, and it shall teach thee; and the fishes of the sea shall declare unto thee. Who knoweth not in all these, that the hand of the **LORD** hath wrought this?”*

* Job xii. 7—9.

ORDER III.—ABRANCHIATA.*

THESE are distinguished, as their name implies, by the absence of all gills, externally: some of them, as the Worms, seem to respire by the whole surface of the skin, and others, as the Leeches, by certain cavities within the body, communicating with the air through minute pores on the sides. These two families are distinguished also by their respective modes of progression; the Worms moving by means of minute bristles, and the Leeches, which are smooth, by a sucker or disk at each extremity.

Besides the preceding characters, the Earth-worms (*Lumbricus* †) are distinguished by a very lengthened body of a cylindrical shape, divided by wrinkles into very numerous rings, amounting in the common species (*L. Terrestris*) to one hundred and twenty; the mouth is destitute of teeth: they have neither tentacles nor eyes. The common Earth-worm may be considered as an useful animal; perforating the ground in every direction with numberless channels, it lightens those clayey soils which otherwise would adhere into impenetrable masses, and gives opportunity for the rain to percolate into every part. To no inconsiderable extent also they doubtless enrich it with manure. White of Selborne observes,—

* *A*, without, and *branchiae*, gills.

† Their Latin name.

“Lands that are subject to frequent inundations are always poor; and probably, the reason may be, because the Worms are drowned. The most insignificant insects and reptiles are of much more consequence, and have much more influence in the economy of nature, than the incurious are aware of; and are mighty in their effect, from their minuteness, which renders them less an object of attention, and from their numbers and fecundity. Earth-worms, though, in appearance, a small and despicable link in the chain of nature, yet, if lost, would make a lamentable chasm. For, to say nothing of half the birds and some quadrupeds, which are almost entirely supported by them, Worms seem to be great promoters of vegetation, which would proceed but lamely without them, by boring, perforating, and loosening the soil, and rendering it pervious to rains and the fibres of plants; by drawing straws and stalks of leaves, and twigs into it; and most of all, by throwing up such infinite numbers of lumps of earth, called worm-casts, which being their excrement, is a fine manure for grain and grass. Worms probably provide new soil for hills and slopes, where the rain washes the earth away; and they affect slopes, probably to avoid being flooded. Gardeners and farmers express their detestation of Worms; the former, because they render their walks unsightly, and make them much work; and the latter, because, *as they think*, Worms eat their green corn. But these men would find, that the earth without Worms would soon become cold, hard-bound, and void of

fermentation, and consequently sterile: and besides, in favour of Worms, it should be hinted, that green corn, plants, and flowers, are not so much injured by them, as by many species of Beetles, and *Tipulæ*, in their *larva* or grub state; and by unnoticed myriads of small shell-less snails, called slugs, which silently and imperceptibly make amazing havoc in the field and garden.”*

In a very interesting paper, read before the Geological Society, by C. Darwin, Esq., it is satisfactorily shewn, that Earth-worms are most valuable agents in fertilizing lands, especially in undisturbed pastures, gradually covering the surface with their casts, and thus forming a layer of finely pulverized earth of the richest character. A field which had been limed, was examined after about eighty years, when the lime was found to be evenly covered to the depth of thirteen inches, with this animal mould.†

The motion of the Worm along the ground is curious. It is performed thus: the head and fore rings of the body are stretched forward and considerably lengthened; then the bristles of these parts, of which there are four pairs on the under side of every ring, are thrust out, and, being strongly pressed against the ground, take a firm hold, while the body is forcibly contracted; the hind parts, being alone at liberty, are of course drawn forward, when the bristles of these rings being in their turn pressed against the ground, afford a resistance, by means of

* Nat. Hist. Selb. p. 231. (Ed. Soc. Pr. Ch. Kn.)

† Proceed. Geol. Soc. vol. ii.

which, the head is again advanced. By a process exactly similar, the animal burrows in the earth; the head being lengthened out to a fine point is inserted into very minute orifices, or between very close particles; a hold being thus obtained for the bristles, the contraction of the body forcibly swelling the rings in proportion to their shortening, enlarges the passage, and thus the Worm is enabled rapidly to move through a substance which would seem, at first sight, to present an impenetrable obstacle to its soft and yielding body.

The Earth-worm subsists upon decaying animal and vegetable substances, which are received into the stomach mixed with much earth. We lately were much interested in observing one taking its food; a few details of which may not be unacceptable. It was on an evening in May, at which time they chiefly begin to come out of their holes: the animal was much lengthened, the tail only just keeping possession of the mouth of its hole. The head, protruded into a long sharp point, was pushing about apparently in search of something, and now and then the under part of it was pressed to the earth and dilated. On close observation, we found that minute fragments of dry stalks, &c. were drawn in; the mouth opened by the turning inside-out of a thick fleshy margin, and the orifice was applied to the fragment, then the lip being drawn in again, the substance was swallowed. Sometimes it would thus seize a slender stalk, a quarter of an inch long, by the end, and suck it in gradually but quickly.

Another of greater length, was seized by the middle, but as it could not be swallowed in this position, and would not bend, it was dragged to the hole, but striking at the mouth, the decaying bark gave way and was swallowed. Occasionally the Worm raised its head, to seize something above the surface, or to explore, as a caterpillar will do at the end of a stick, and at such times the mouth and fleshy lip were very visible. It at length got hold of a pebble, thicker than itself, and drew it into the hole, probably to seal up the entrance as a protection, for it did not again appear.

The Leeches (*Hirudo**) are of a lengthened form, generally flattened, marked with very many transverse wrinkles. At each extremity is a fleshy disk, which acts as a sucker in progression; the head being stretched forward to its fullest extent, the fore-sucker is attached; the rings are powerfully contracted, and the hind-sucker attached near the former, which is then loosened, and thrust forward as before. The Leech, however, can swim with much elegance, though not with rapidity; this is performed by quick serpentine waves perpendicularly, the body being flattened into a thin band. The instinct which induces the Leech so greedily to suck the blood of other animals, has been turned by man into a very valuable means of alleviating human suffering. Its mouth, situated in the middle of the front sucker, has three little teeth placed triangularly, each with a saw-like edge: and when the action of the sucker has made

* Their ancient Latin name.

the skin of the patient tense, these teeth are pressed against it, until three cuts are made to some depth, and the blood thus liberated, is sucked largely into the stomach of the animal. It would appear that this instinct is a direct and exclusive ordination of Providence for man's advantage. That blood is not the natural food of the animal, is probable from the fact that, in the streams and pools which they inhabit, not one in a hundred, could in the common course of things ever indulge such an appetite; and even when received into the stomach, it does not appear to be digested; for though it will remain there for weeks without coagulating or becoming putrid, yet the animal usually dies, unless the blood be vomited through the mouth. The demands for these useful creatures, at least for one species, the Medicinal Leech (*H. Medicinalis*), for the purposes of surgery, have caused them to become scarce with us, but great numbers are annually imported from the continent. The following brief notice of Leech-fishing in France, from the Medical Gazette, is so graphic, that we willingly quote it:

“ If ever you pass through La Brenne, you will see a man, pale and straight-haired, with a woollen cap on his head, and his legs and arms naked: he walks along the borders of a marsh, among the spots left dry by the surrounding waters, but particularly wherever the vegetation seems to preserve the subjacent soil undisturbed; this man is a Leech-fisher. To see him from a distance, his woe-begone aspect, his hollow eyes, his livid lips, his singular gestures,—

you would take him for a patient who had left his sick-bed in a fit of delirium. If you observe him every now and then raising his legs, and examining them one after the other, you might suppose him a fool; but he is an intelligent Leech-fisher. The Leeches attach themselves to his legs and feet, as he moves among their haunts; he feels their presence from their bite, and gathers them as they cluster about the roots of the bullrushes and weeds, or beneath the stones covered with green and gluey moss. Some repose on the mud, while others swim about, but so slowly, that they are easily gathered with the hand. In a favourable season, it is possible, in the course of three or four hours, to stow ten or twelve dozen of them in the little bag which the gatherer carries on his shoulder. Sometimes you will see the Leech-fisher armed with a kind of spear or harpoon; with this he deposits pieces of decayed animal matter, in places frequented by the Leeches; they soon gather round the prey, and are presently themselves gathered into a little vessel half full of water.

“One of the traders,—what with his own fishing, and that of his own children, and what with his acquisitions from the carriers, who sell quantities second-hand,—was enabled to hoard up 17,500 leeches, in the course of a few months; he kept them deposited in a place where, in one night, they all became frozen *en masse*. But the frost does not immediately kill them; they may generally be thawed into life again. They easily, indeed, bear very hard

usage. I am told by one of the carriers, that he can pack them as closely as he pleases, in the moist sack which he ties behind his saddle; and sometimes he stows his cloak and boots on the top of the sack. The trader buys his leeches *pell mell*, big and little, green and black,—all the same: but he afterwards sorts them for the market. Those are accounted the best which are of a green ground, with yellow stripes along the body."

Unlike the Earth-worm, the Leech is furnished with eyes, exceedingly rudimentary, however, in their structure, and so minute, as to be detected only with the microscope. They are about eight or ten in number, situated on the surface of the front sucker, just before the mouth: a position which, strange as it seems, undoubtedly renders them more useful to the animal, particularly in seeking its food.

FOURTH GREAT DIVISION.

RADIATA.*

In all the varied forms which have as yet fallen under our notice, there has been an arrangement of the external organs on each side of an imaginary line running down the body, so that if the animal were split in this line, the one portion should, externally, exactly correspond to the other. But in the inferior forms we now meet with, this arrangement no longer exists; there is no longer any definite part, of which we may say, this is the fore, or this the hind extremity; this is the right, or this the left side. Yet these creatures are not shapeless, nor devoid of symmetry, but it is a symmetry of a peculiar character. The organs are no longer disposed in a longitudinal parallel series, but in a circular form, being arranged round a centre. It is true, this radiation is in a few cases scarcely observable without anatomical examination, but it is the general character, and commonly quite obvious.

The creatures of this Division, going down to the very bottom of the animated scale, where animal life seems, indeed, to merge into vegetable, so gra-

* *Radio*, to diverge from a centre, as the spokes of a wheel.

dually as with difficulty to be separated, are, as might be supposed, very diverse in their structure and degree of perfection. In the very highest, however, the nervous matter is not collected into knots or *ganglia*, connected by continuous cords, and therefore their senses, except that of touch, are feeble, if not entirely wanting; there is no organ answering to a heart, and no circulation of anything like blood; and generally no distinction of sex: while in the lowest, we see nothing but a simple mass of thin jelly, alike in every part, without any organs that we can discover, and without any tokens of life, save in alternate contraction and dilatation. Yet some of these animals, and those almost the lowest in the scale, have been employed by God, to perform mighty works in our world, such as erecting barriers against the fury of the ocean, and raising from its fathomless depths spacious islands for the habitation of man.

CLASS I.—ECHINODERMATA.*

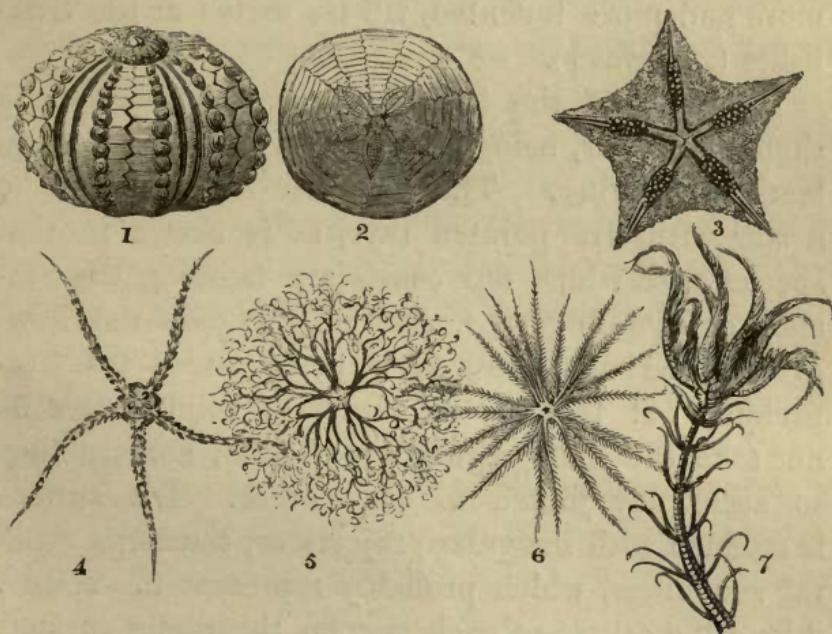
IN these animals we find a thick skin, crustaceous or leathery in its texture, and in many cases thickly clothed with spines. They are all marine animals, some of them swimming in the ocean, but the majority having a very peculiar apparatus for crawling, consisting of a vast number of slender fleshy tubes, protruded at will through round holes on the skin, and terminating in flat suckers. Few, on comparing that very singular animal called a Lily-stone (*Encrinus*) with a Sea-urchin, (*Echinus*), would be able to discover the slightest resemblance between them, or would suspect that these two creatures could have been formed on one common plan. Yet so it is; the interval being filled by species approaching each other so gradually, that they form an unbroken series.

One of the most common species of this Order on our own shores is the Eatable Sea-Urchin (*Echinus Esculentus*). It much resembles in form and size an orange, composed of five segments, like the divisions visible in that fruit when the rind is removed. On each segment are two rows of half-round knobs, like little nipples, on each of which a blunt spine is placed, working on it by a

* Ἐχῖνος, *echinos*, a hedgehog, and δέρμα, *derma*, the skin.

ball-and-socket joint, so as to turn in various directions. Between these two rows run down two channels, perforated with hundreds of minute holes, through which are protruded or drawn back the sucker-feet. Multitudes of smaller spines project in all directions from the surface of the skin, besides the larger ones above mentioned. Every segment is composed of many pieces of a regular six-sided figure, which are dovetailed into each other with beautiful precision ; an admirable arrangement, by which alone the growth of the animal could be permitted. For if the shell were composed of one continuous piece, formed as it is by deposition from the surface of the animal, it is plain that every layer deposited would diminish the interior, while the contained animal would be ever increasing in size. But, as it is, every one of these six-sided pieces is increased by layers on its inner surface, each layer being a little wider than the preceding ; and thus each piece gradually enlarges, (and consequently the whole shell,) while at the same time the definite form of each is exactly retained. On the under surface of this flattened sphere, in the point where all the divisions meet, as in one of the poles, is situated the mouth, curiously furnished with five hard and sharp teeth, somewhat like the incisors of a Squirrel, the points of which meet in the centre. The food of these creatures is altogether animal; and, though the Sea-urchin does not seem at first sight very well qualified to pursue or to seize prey, yet its organs doubtless correspond to

its wants and instincts. Small Mollusca and Crustacea appear to be its chief diet; and if an animal of this kind be but touched by one or two of the sucker-feet, its doom is sealed; the hold is never relinquished, other suckers are applied to it until it is passed round to the mouth, whose formidable jaws are able to crush the stony shell, or crustaceous covering.



ECHINODERMATA.—Fig. 1. *Echinus*; 2. *Scutella*; 3. *Asterias*; 4. *Ophiurus*; 5. *Gorgonocephalus*; 6. *Comatula*; 7. *Encrinus*.

From this rounded form, other species, more and more flattened, gradually lead to the genus *Scutella*,* which takes the form of a thin round plate,

* *Scutella*, a dish like a shield.

quite flat beneath, but slightly convex on the upper surface. The structure is the same as before; but the spines appear to the naked eye only as very minute hairs; but when magnified are found to be of most elaborate workmanship, each having a moveable socket-joint. In the genus *Clypeaster*,* the round outline is changed for a five-sided figure; the angles of which in succeeding species project more and more, and the spaces between become more and more indented, till we arrive at the Star-fishes (*Asterias*†).

The skin of the Star-fishes does not assume a shelly character, being merely of a dense and tough leathery texture. The common form is that of a star with five pointed rays, as is shewn in that species with which our coasts are familiar, the Sea-star, or Five-finger (*A. Rubens*). It does not, however, materially differ in structure from the Sea-urchin; but the minute pieces of solid matter do not take the same regularity of form, nor are they so accurately joined to each other. The surface is studded with irregular projections, causing a general roughness, which probably represent the spines. Along the centre of each ray, on the under surface, run the furrows studded with minute holes, from which project sucker-feet, as in the above genus. The mouth, in the centre of the under side, is surrounded by a bony ring, but is destitute of teeth. Yet the Star-fish is very voracious, swallowing small shelled Mollusca whole, and afterwards disgorging the

* *Clypeus*, a shield, and *aster*, a star.

† Their Greek name. *

empty shells, and, as is believed, devouring larger ones out of their shells. So destructive is this animal considered to Oysters, that in some old Admiralty regulations, among other protective statutes, a penalty is denounced against every one who, on seeing the "Five-finger," does not either crush it beneath his feet, or throw it out of the reach of the tide. It appears from some observations of M. Deslongchamps, that it pours into the shell some poisoning fluid, and that then the animal is sucked out by the insertion of some fleshy tubes which project from around the mouth.

The rays gradually becoming longer and more slender, we are brought to those in which they are so lengthened as to resemble the tails of so many serpents, whence they are named *Ophiurus*.* The feet are found only upon the small central part or body; but the long rays being very flexible are used as legs to crawl upon, or even as fins, supporting the animal for a short time by a waving motion. In succeeding genera, such as that called Medusa's head, (*Gorgonocephalus*,†) the central part is still further diminished, and the rays are divided into branches of great length and number. Each ray, soon after its commencement, separates into two branches, each of which, at a short distance, divides into two more; these again into two others, and so on, to an astonishing extent. Upwards of two thousand five hundred ramifications have been count-

* "Οφις, ophis, a serpent, and οὐρά, oura, a tail.

† Γοργόνες, Gorgones, the Furies, and κεφαλή, kephale, the head.

ed on a single specimen, presenting a living net, by the contraction of which any small animal once touched would inevitably be detained. The sucker-feet are no longer found, these animals changing their position by dragging themselves along by their flexible arms. In *Comatula*,* each ray separates into three or four very slender ones of equal length, composed of innumerable shelly joints enveloped in a fleshy covering, and sending out from their sides numberless short and parallel filaments, like the beards of a feather, each having an internal earthy skeleton, and capable of independent motion. They appear to be used as the branched arms of the last genus for the purposes of motion, and of taking prey. The central part, containing the organs of the body, is exceedingly small. The Lily-stone, (*Pentacrinus*,†) which so abundantly occurs in a fossil state, and of which one living species is found in our own seas, is an animal formed exactly as the last genus, but is placed at the extremity of a long jointed stalk of a similar character to the rays, from the sides of which at intervals proceed long jointed filaments. The whole form is that of a lily-like plant; and, to add to the resemblance, the creature is fixed by its base to the solid rock. Thus we have endeavoured briefly to trace one of the most beautiful and most instructive gradations in the whole chain of Nature, connecting, by insensible steps, forms apparently the most distant and unlike that could be conceived.

* *Comatulus*, somewhat hairy. † Πέντε, pente, five ; κρίνων, *krinon*, a lily.

CLASS II.—ENTOZOA.*

THE animals before us, usually called Intestinal Worms, reside for the most part in the interior of other animals while in a living state. There is scarcely a single species which is not the habitation of some one or more of these obscene creatures, from Man to the meanest Insect; and even some of these Worms themselves are found to contain other species which feed upon *them*. They inhabit not only the intestines, but, to a greater or less extent, all parts of the body, such as the stomach, the liver, the brain, the eye, and even the tissue that divides one muscle from another. No creatures are more calculated to humble the pride of human knowledge than these, for there is not a more difficult problem in the whole range of natural science than the origin of internal Worms. It appears certain that they are found in an animal at its birth; and hence some naturalists have been compelled to the old supposition, however improbable it may seem, that they are produced spontaneously, life being not communicated, but created in each individual. But this is so utterly contrary to all other experience, that most prefer to believe that the eggs or germs of these creatures exist in the water, air, or earth around us, but in forms not to be disco-

* *'Εντος, entos, within, and ζωον, zoon, an animal.*

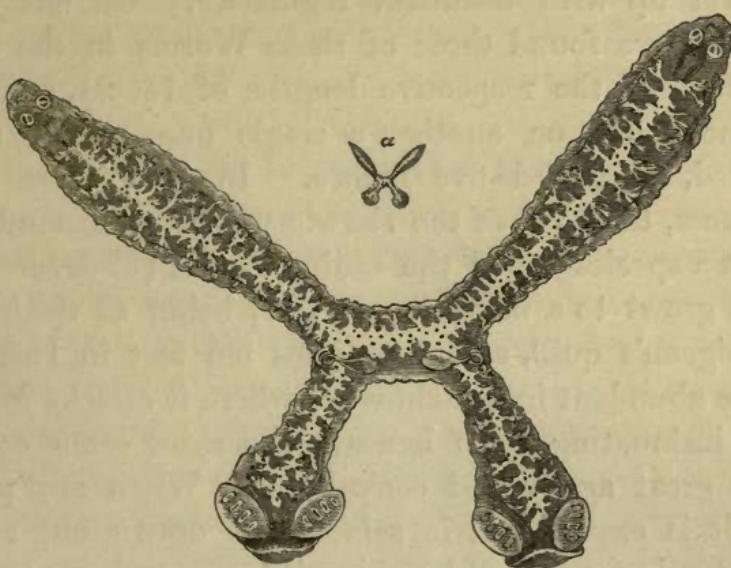
vered or recognised ; and that, being inconceivably small, they are received with food, or in some other way, into the body, and pass with the blood or other fluids through the minutest vessels to their respective destinations, where, stimulated by constant warmth, and highly nutritive food, they grow to a size which in other circumstances they could never have approached. Either of these suppositions, however, seems beset with almost insurmountable difficulties.

These animals vary much in their structure and form, some being comparatively complicated, while others are very simple. Of the former kind is the Fluke, (*Distoma Hepaticum*,*) well known as inhabiting the liver of the Sheep, but found also in other animals, and even in Man. It resembles in form a little Sole, about an inch in length, furnished with two suckers, each of which was supposed to contain a mouth, but one of them has been since found to be simple. When sheep are pastured in low wet meadows, this animal often multiplies excessively in them, producing dropsy, or rot, and finally death.

One of the most singular of all known forms is seen in an animal resembling the Fluke in its internal structure, the Twin-worm (*Diplozoon† Paradoxum*). It literally possesses two bodies, each precisely resembling the other, and united by a band, which passes

* Δύο, duo, two, and στόμα, stoma, a mouth; and ἡπατικὸς, hepaticos, belonging to the liver.

† διπλόος, diploos, double, and ζῷον, zoon, an animal.



THE TWIN-WORM (*Diplozoon Paradoxum*); *a.* nat. size.

from the middle of one to the other, reminding the observer of the Siamese twins recently exhibited. This strange little creature, not more than a quarter of an inch in length, is found attached to the leaves of the gills in the Common Bream, (*Cyprinus Bramus*,) to which it adheres by suckers at each of the four extremities, and from which it derives its nutriment.

The Thread-worms (*Filaria**) are exceedingly slender, resembling white threads, often of great length, infesting the intestines of Man, as well as other animals. They are found in very many species of Insects, and even in their *larvæ*. We have repeatedly extracted them from the common Earwig,

* *Filum*, a thread.

coiled up with beautiful regularity. On one occasion, we found three of these Worms in the abdomen, of the respective lengths of $1\frac{1}{2}$, $2\frac{1}{2}$, and $3\frac{1}{2}$ inches; and on another a single one, which, uncoiled, measured five inches. In both these instances, the body of the Earwig was much distended. But a species called the Guinea-worm (*F. Medinen-sis*) grows to a much larger size, being as thick as a pigeon's quill, and sometimes ten feet in length. It is abundant in hot climates, where it attacks Man, by insinuating itself beneath the skin, often causing great agony and convulsions. When any part of it is exposed, it is seized and drawn out very gradually for fear of breaking it.

Even these, however, are insignificant compared with the horrible Tape-worms, (*Tænia*,*) which are too well-known as inhabiting the human bowels. They are flat, and composed of a vast number of square joints, which become very slender towards the head, and so tender that specimens with the fore parts unbroken are rarely found. The head is a square organ, furnished with a mouth in the centre, armed with spines, and surrounded by four suckers. They grow to an immense length, the common species (*T. Solium*) being sometimes thirty feet in length, and another (*T. Lata*) more than a hundred feet. It may easily be imagined how exhausting must be the incessant attacks of these merciless harpies, almost realizing the fabled vulture of Prometheus.

* *Tænia, tainia*, a ribbon.

CLASS III.—ROTIFERA.*

THE invention of the Microscope opened up to the consideration of man a world of beings, of which he had not before the most remote idea; animals far too small to be detected by the unassisted eye, yet displaying equally with the Elephant and the Whale the operation of Infinite Wisdom and Skill in their formation. They have been usually called Infusory Animals, from their swarming in waters in which any vegetable or animal substance has been for a few days infused; or, simply, Animalcules, from their minuteness. Modern investigations have proved, however, that these "minims of existence" have little in common except their size; that while some (*Monas*†) appear only as moving points, without any apparent organs, others, as the *Rotifera*, present a highly complicated system, approaching even the *Crustacea*. Of course, animals differing so much as these ought not to be placed together; yet, in a work like the present, we may be permitted to dismiss the former with a brief notice, even while professedly considering the more highly organized animals of the latter description. The section, then, of which we have taken the *Monas* as an example, consists of moving atoms of

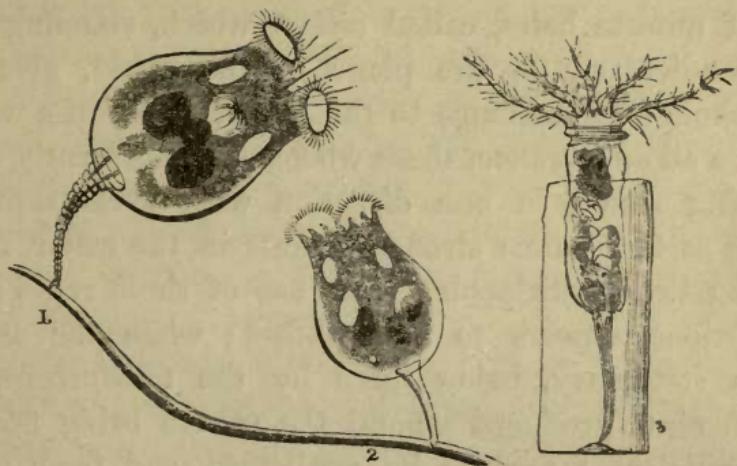
* *Rota*, a wheel, and *fero*, to bear.

† *Movas*, *monas*, an unit.

inconceivable minuteness, yet varying greatly in shape ; some appear a thin oval plate, some are globular, some eel-shaped, some pear-shaped, some bell-shaped ; while others have no defined shape, their outline perpetually changing. With respect to their size and number, "Dr. Ehrenberg has described Monads which are not larger than from $\frac{1}{1000}$ to $\frac{2}{1000}$ of a line,* and which appeared to be separated from each other by intervals not greater than their diameter. Each cubic inch of the water in which they are found must contain, therefore, eight hundred thousand millions of these animalcules, estimating them to occupy but one fourth of its space." Some of them are enclosed in transparent shells. A powdery substance is abundantly found near Lake Lettsnaggsjon, in Sweden, which from its extreme fineness resembles flour ; this has long been known to the natives of the region where it is plentiful under the name of Bergmehl, or mountain meal ; and is used by them, mixed up with flour, as an article of food, experience having taught them that it is highly nutritive. On examination with the microscope, this meal is found to consist entirely of the shells of these animalcules, which have been accumulating for ages at the bottom of the waters in which the living animals are found, forming a stratum of considerable thickness.

The *Rotifera*, or Wheel-bearers, are also partially enclosed in a shell of exquisite delicacy and transparency, which usually resembles in shape a

* A line is the twelfth part of an inch.



ROTIFERA : 1 and 2, *Brachionus Urceolaris* ; 3, *Stephanocerus Eichornii*.

goblet, or rummer, with the foot broken off; what we may call the stem of the goblet is a flexible tail, varying in length, and usually terminated by a pair of moveable forceps, by which the animal fastens itself to the stalks of aquatic plants, &c. The edge of the shell, or mouth, is often cut into teeth, or wavy processes. The animal, when at rest, is drawn within the shell; but, when active, the fore parts are, as it were, turned inside out, and so protrude from the shell, exhibiting a simple orifice, which is the mouth, leading down to a singular gizzard, where the food is bruised before it passes into the true stomach. On each side of the mouth are placed the curious wheels, from which the animals are named. In most cases they are two in

number, but in some there are four. Each wheel consists of a circular disk, surrounded by a fringe of minute hairs, called *cilia*,* which, standing perpendicularly to the plane of the circle, give the whole a resemblance to the crown wheel of a watch. To all appearance, these wheels are incessantly spinning round in one direction with great rapidity, so as to produce strong currents in the water, forming little whirlpools. The use of these rapid revolutions appears to be two-fold; when the animal is stationary, being fixed by the tail-forceps, the currents produced around the mouth bring floating particles of food to be swallowed, and fresh water to be respired; on the other hand, if disengaged, the wheels, like the paddles of a steam-boat, urge it rapidly through the water with an easy gliding motion.

It was long supposed that these motions were real revolutions of the wheels; but it is now clearly established that they are merely an optical illusion, exactly similar to that by which, when the waves are rolling in upon a beach, the *particles of water* appear to the eye to move rapidly forward, while, as is well known, they merely rise and fall perpendicularly in constant succession. Dr. A. Farre remarks, that under high magnifying powers, "the *cilia* have the appearance of moving in waves, in the production of each of which from a dozen to twenty *cilia* are concerned, the highest point of each wave being formed by a *cilium* extended to its full length,

* Literally, eye-lashes.

and the lowest point between every two waves by one folded down completely upon itself, the intervening space being completed by others in every degree of extension, so as to present something of the outline of a cone. As the continuance of each *cilium* in any one of these positions is of the shortest possible duration, and each takes up in regular succession the action of the adjoining one, that *cilium* which, by being completely folded up, formed the lowest point between any two waves, in its turn by its complete extension forms the highest point of a wave ; and thus, while the *cilia* are alternately bending and unbending themselves, each in regular succession after the other, the *waves* only travel onward, while the *cilia* never change their position in this direction, having, in fact, no lateral motion."*

These beautiful but minute creatures are often found in abundance in the leaden shoots of roofs, among the sediment left by rain-water, in the form of dust. If the dried sediment have any particles of a reddish or dark brown colour, it is almost sure to contain them ; and on being steeped awhile in water, these atoms will revive, and display the forms and motions described above.

* Philosophical Transactions, 1837.

CLASS IV.—ACALEPHA.*

No one can have sailed over the ocean, or even been in the habit of walking on its shores, without observing numerous creatures of various sizes and forms, but all bearing the appearance of an uniform mass of clear jelly, having generally a visible contraction and dilatation, but very little of any other voluntary motion. Many of them have certain long strings, or fringed processes, hanging from them as they float, which are found, when touched, to communicate a severe smarting sensation to the skin, similar to the sting of a nettle, but often far more violent. From this property, and from their texture, they are usually known by the names of Sea-nettle, Sea-blubber, or Sea-jelly. The most common form is that of a hemisphere, from six inches to a foot in diameter, having a loose edge or fringe, floating at the surface of the sea with the convex side upwards; while from the under side depends a thick mass of wrinkled and fringed organs, which probably serve as tentacles for the procuring of food. The whole creature thus has no slight resemblance to a large mushroom. These may often be seen in great numbers in the Atlantic, in all parts of it, and are often washed up on the sea-beach, where, however, they soon entirely

* Ἀκαληφὴ, *akalephe*, a nettle.

melt away. If one of them be taken from the sea alive, it is found to be very heavy, but of so delicate a texture that it cannot be held in the hand, the fingers penetrating and dividing its substance, so that it falls into a shapeless mass merely by its own weight. It is, in fact, an *animated mass of sea water*. "If we take a Medusa of any size, and lay it in a dry place, it will be found gradually to drain away, leaving nothing behind but a small quantity of transparent cellular matter, almost as delicate as a cobweb, which apparently formed all the solid frame-work of the body, and which, in an animal weighing five or six pounds, will scarcely amount to as many grains ; and even if the water which has escaped be collected and examined, it will be found to differ in no sensible degree from the element in which the creature lived."*

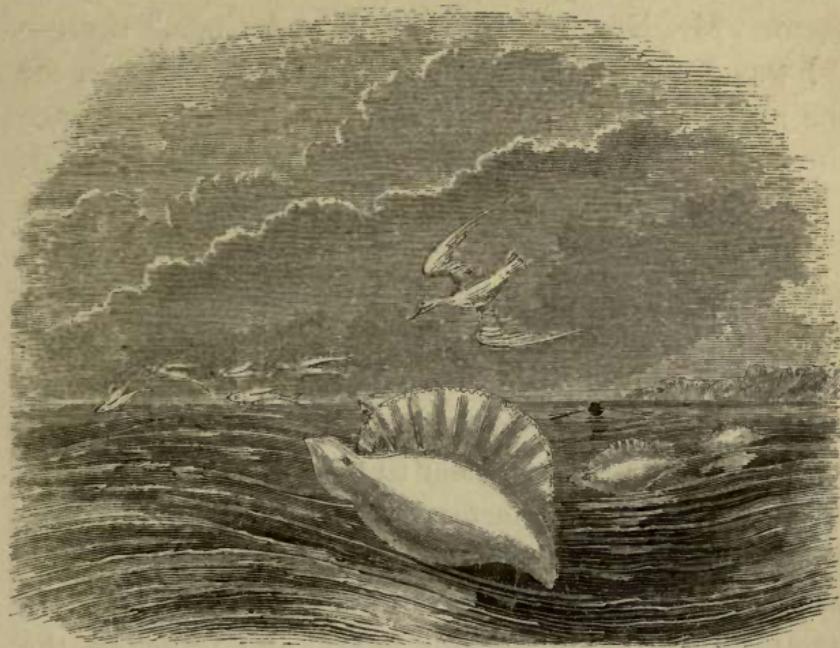
The motion of these animals consists of an alternate contraction and opening of their disk, performed with great regularity about fifteen times in a minute. They are generally transparent ; yet, in some, the centre of the convexity displays four rings, set in a square form, of a flesh colour, or delicate pink. Some of the species give out a phosphoric light in the dark, of such dazzling splendour, that they may be seen far below a ship's keel, like cannon-balls heated to whiteness. From the more minute kinds, in conjunction with some of the *Mollusca* already noticed, arises a great deal of that brilliancy which is so vividly seen in a ves-

* Jones, Anim. Kingd. p. 65.

sel's wake, and especially just beneath her stern, in the eddies made by the motion of the rudder; and perhaps those fitful flashes which now and then gleam over the rising waves may have a similar origin.

Of the remaining *Acalepha*, we shall notice only one species, the *Physalis** *Pelagica*, familiarly known to seamen by the name of the Portuguese man-of-war. In the tropical parts of the Atlantic this lovely little creature abounds, looking at a short distance exactly like a child's mimic ship, and attracts our wonder and admiration to see so delicate and frail a bark breasting the broad billows, as it seems that the first breaking sea must inevitably overwhelm and dash it to pieces. Yet, there it floats and dances,—now on the curling crest, now in the deep hollow, in spite of wind and wave. Often, when passing just under the lee of a vessel, the sudden lull made by the interposition of so great a body between it and the wind will cause it momentarily to lie flat on the water, but it instantly resumes its upright position. We have never made a voyage without seeing these creatures in greater or less number, but nowhere in such profusion as in the Gulf of Mexico. In rounding the Florida Reef, we were once nearly a whole day sailing through a fleet of them, which studded the smooth sea as far as the eye could reach. They were of all sizes, from an inch in length to a foot or more. When examined closely, the animal is seen to consist of an oblong transparent bladder, pinched up at the

* Φυτζλις, *physalis*, a bubble.



PORtUGUESE MAN-OF-WAR (*Physalis Pelagica*).

upper part into a kind of rumpled edge ; this edge is of a delicate pink, but the lower part of the bladder is fine blue, and both these colours are gradually softened into the clear membrane, the middle of which is colourless. From one end of the bottom proceeds a large bunch of tentacles, like strings, hanging down in the water ; these are of a brilliant purple. The vividness of the colours varies much, some being only of a pure white above ; they differ much also in beauty of form : in some, the *sail* is merely a narrow ridge or border, in others it rises into a tall and wide semicircular membrane. The hanging tentacles have, in a very formidable

degree, the faculty of stinging the hand that touches them. Mr. Bennett, in his "Wanderings," says,— "I was desirous of trying its effects on myself, for the purpose of ascertaining from personal experience the constitutional irritative effects resulting from it. On taking hold of the animal, it raised its tentacula and stung me on the second and ring fingers; the sensation was similar at first to that produced by the nettle; and, before a few minutes had elapsed, a violent aching pain succeeded, affecting more severely the joints of the fingers. On cold water being applied, it was found rather to increase than diminish the effects. In a quarter of an hour, the fore-arm and elbow were severely affected, till at length it became almost unbearable, and gradually extended itself to the shoulder and chest, and impeded the breathing. These symptoms continued for about half an hour, when they gradually abated; but the arm was benumbed for the remainder of the day." It is probable that this formidable power is given to them by Divine Wisdom, not only for defence, but for numbing the living animals on which they feed; for, helpless as these creatures seem, they are able to seize *Crustacea* and other animals with their tentacles, and drag them to their mouth, where they are soon swallowed and dissolved.

CLASS V.—POLYPI.*

As we draw near the confines of the animal world, it is interesting to observe how closely many of the subjects of consideration approach to vegetables, not only in the simplicity of their structure, but even in their forms, colours, and general appearance. We have already seen some illustrations of this resemblance in the *Echinodermata*; but, in the present Class, much lower in the scale than they, the likeness is so great that many of them were arranged by the older naturalists with plants; and some of the very lowest have been, even in the present day, and among eminent zoologists, subjects of dispute as to their appropriate situation.

These animals usually consist of a cylindrical body, open at one extremity, around which opening are placed several simple tentacles, varying greatly in number and form. They generally consist of an uniform jelly-like substance, without any internal vessels save the single cavity of the body; a few have other vessels, but even these are without coats, being merely hollowed out of the jelly-like flesh. Almost all are capable of multiplying their race by sending out shoots in the manner of buds, and also by the separation of their bodies into parts

* Πολύς, *polys*, many, and πόντος, *pous*, a foot.

by violence, every single piece into which a Polype may be divided producing the parts which are deficient, and thus becoming a complete animal. In both these modes of propagation, we see their close affinity with vegetables. But a few possess a third mode of propagation by a kind of eggs, called *gemmules*.

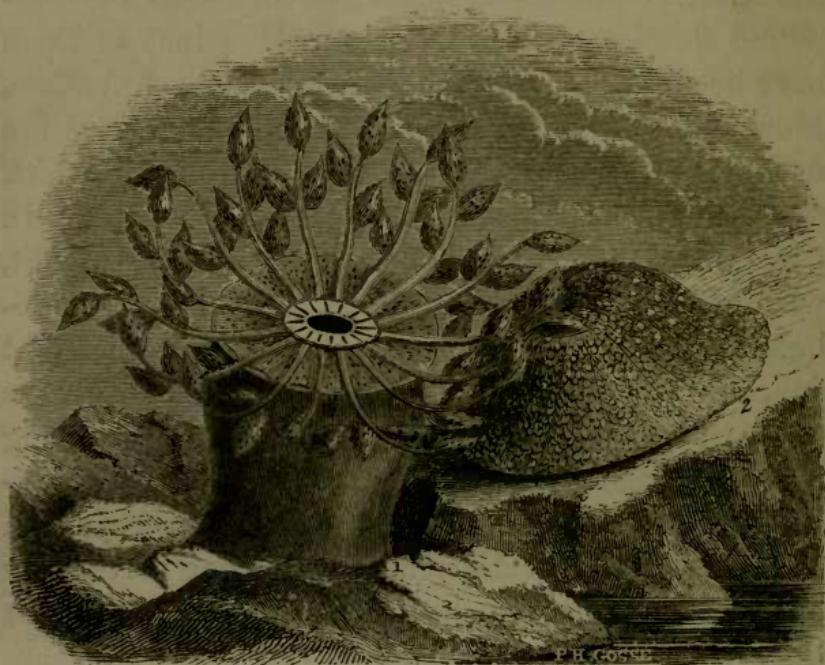
The whole Class consists of aquatic animals; a few inhabit fresh waters, but the greater number are marine, being found in all seas from the Equator to the Poles. It is in the tropical seas, however, that we meet with these singular forms in their greatest variety, magnitude, and beauty; particularly those genera which deposit a stony skeleton, and which live in aggregated numbers: by far the most interesting of the Class.

ORDER I.—CARNOSI.*

THE animals of this division are often exceedingly beautiful, representing the large blossoms of compound flowers, gorgeously coloured. Many of them have been named after such flowers as the Anemone, Marigold, Aster, Cereus, Carnation, &c. They are usually attached to rocks by a broad base, on which they can slowly crawl, in the manner of a Slug. In general, their breadth is greater than their height, when closed, at which time they look like a semiglobular or bell-shaped mass of firm flesh, with a slight depression or closed orifice in the centre. Beneath the water, if undisturbed, this orifice enlarges by turning inside out, and displays a vast number of short tentacles, radiating around its margin, like the rays of a daisy. These tentacles adhere with some pertinacity to the hand when touched, and often leave a slight tingling or stinging sensation in the skin: they are the natural instruments of seizing prey, which consists of *Mollusca* and *Crustacea* of considerable size: no sooner does one of these animals touch a tentacle, than it is instantly arrested, and drawn in to the central mouth; where although as large as the assailant itself, it is by the enormous distension of the mouth sucked into the cavity of the body, and

* *Carnosus*, fleshy.

digested, the empty shell being, after some hours, disgorged through the same aperture. The young are formed in the interior of the body, and vomited through the mouth; but occasionally they push through the flesh, and, appearing on the surface like buds, gradually disengage themselves. These marine-



ANIMAL-FLOWERS : 1. *Actinia Alcyonoides* ; 2. *A. Gemmacea*.

flowers are very interesting subjects of observation, when kept alive in a glass vessel of sea-water, especially as they do not require much attention beyond the occasional change of their water; for, though voracious, they are capable of long abstinence. They are easily procured, as our rocky shores abound with

them; we have seen the stones in Swanage Bay almost covered with them at low-water, and among them a very beautiful species, (*Actinia* Gemmacea*,) of an oval shape, about two inches in diameter, of a fine purple or crimson hue, studded with bright green dots.

Some of these animal-flowers are eaten; Dicquemare says of *A. Gemmacea*,—"Of all the kinds of Sea Anemones, I would prefer this for the table: being boiled some time in sea-water, they acquire a firm and palatable consistence, and may then be eaten with any kind of sauce. They are of an inviting appearance, of a light, shivering texture, and of a soft white and reddish hue. Their smell is not unlike that of a warm crab or lobster."†

* Ἀκτίνη, *aktin*, a ray of the sun.

† Phil. Trans. abr. xiii. 637.

ORDER II.—GELATINOSI.*

THESE are distinguished from the preceding, by a much greater simplicity of structure, as well as by less firmness of texture; consisting of nothing more than a simple oblong bag of jelly-like flesh without skin, furnished with a few tentacles around the mouth. Some are placed upon a footstalk, and are visible only with the microscope. The best known genus is the fresh-water Polype, (*Hydra*,†) several species of which are abundant in our own country, in stagnant pools and ditches. They consist of a delicate transparent tube, from half an inch to an inch in length when fully extended, attached at one end to the stalks of water plants, by a little sucker, and furnished at the other with from six to a dozen slender tentacles, spread in form of a star around the mouth. The substance of the body is somewhat like shagreen, shewing a great number of little detached grains, of a green colour in the commonest species, set in a clear jelly, without skin, membranes, or vessels of any kind. The tentacles are not usually longer than the body, but in one species, the long-armed *Hydra*, (*H. Fusca*,) they extend to the length of eight inches, but of extreme slenderness, like a fine hair. The tenta-

* *Gelatinosus*, jelly-like.

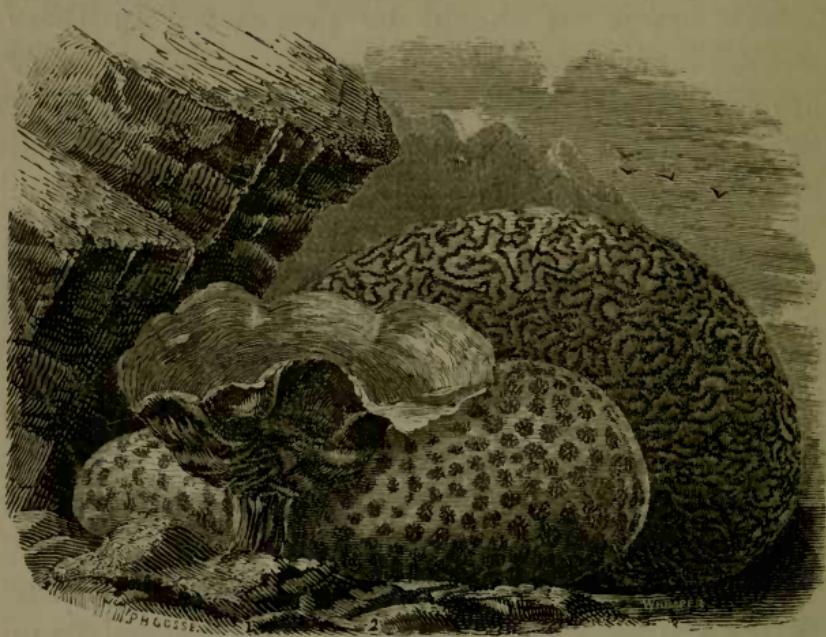
† Named after the fabled monster of that name; from its power of reproducing parts cut off.

cles or arms are usually extended in search of prey, and as we have seen before in other cases, the instant some little Water-flea, or Bloodworm, or Gnat-grub, touches one of them, its doom is sealed, it is fixed as if by magic to the almost invisible thread, in spite of its struggles to escape; the tentacle then gradually contracts, and others coming in contact with the victim, it is soon drawn to the mouth and forced into the sac. From the transparency of the *Hydra*, the swallowed prey may be distinctly seen in its stomach; if watched, it is seen to become gradually indistinct in its outline, passing into the form of a slight cloudy mass, until at length it totally disappears, except any indigestible portion, such as the shell of a *Crustacean*, which is disgorged from the mouth. Although the process of digestion is energetic and rapid, it does not act on any part of the animal itself; the tentacles of the long-armed Polype, are frequently passed into its own stomach coiled around its victim, where they remain until it is digested, without injury; and what is more singular still, a living Polype may be swallowed by another with impunity. M. Trembley once saw an amusing proof of this: two *Hydræ* had seized the same prey, and each had begun to swallow it at opposite ends: after a little tugging, the larger of the two, opening his mouth with an unusual effort, fairly swallowed his opponent, worm and all. The observer reasonably supposed that the engulphed Polype was "but a gone monster" now: but no; after remaining snugly lodged until the two had digested the worm

between them, the prisoner was expelled through the mouth safe and sound.

But the most remarkable circumstance in the history of these animals is their power of reproduction, the discovery of which, about a hundred years ago, completely electrified the scientific world. It is found that the means which would ensure the instant death of most animals, applied to these, communicates and multiplies life without limit. For, if a *Hydra* be cut into pieces, each individual fragment, however small, will speedily become a perfect animal in all respects like the original, the parts which were defective being produced in their proper situations. If with fine scissors we slit one half down, the result will be a *Hydra* with two mouths, each surrounded with the usual number of tentacles; if these be again, and again, and again divided, each division will cause new heads, thus forming a realization of the fable of the Lernean Hydra. Every one of the tentacles of this new-formed monster will capture food, and all the mouths will devour it. But this is not all. They may actually be grafted. If two be cut across, and the fore part of one be applied to the hind part of the other, and slightly pressed to it for a few moments, the two parts will unite, and form a perfect Polype, without leaving a scar. One may be thrust down into the stomach of another, in which condition they will unite and form a Polype, with a double number of tentacles. They may even be turned inside out, like a glove, without injury, and in this state will remain; that which was the external

surface, now being the stomach, and the contrary. Of course it was not intended by God, that the animals before us should be propagated in these artificial modes, but the facts are interesting, because they prove that the life is equally diffused throughout the substance, and that each atom is endowed with all the functions necessary to the formation of a complete animal. The ordinary mode of increase is by the young animals budding from the side of the adult, and detaching themselves; but previously to their separation, they themselves often send out side-buds, so that several generations may sometimes be seen branching from one parent. Trembley has seen nineteen young of various ages growing on one, their numerous long tentacles twining about in inextricable confusion. The young capture prey with their tentacles some time before they are detached from the parent; the food in such case passing through the infant into the maternal stomach. The point of connexion, however, becoming gradually narrowed, the young one at length separates to commence its own independent existence.



ORDER III.—CORALLIFERI.*

MADREPORES : 1. *Astrea* — ? , 2. *Agaricia Undulata*, 3. *Meandrina Cerebriformis*.

THE Polypes of this Order, comprising very many species, agree in general with those of the former two in their individual structure, but are so united together in societies, as to form a common mass, nourished and increased by the efforts of all. This substance does not, however, appear to have, as has been maintained, any sensation, or power of communicating sensations from one Polype to another,

* Κοράλλιον, korallion, coral, and, φέρω, phero, to bear.

nor to be anything more than a support for the various individuals, which move and act each with an independent perception and will. It varies greatly in texture, sometimes being fleshy or gristly, sometimes horny, and sometimes stony; and also in form and position, sometimes being a shapeless mass, sometimes a jointed internal skeleton, sometimes a branched trunk, and sometimes a series of shelly tubes. The Organ-pipe, (*Tubipora* Musica*,) often seen in cabinets, is a beautiful example of this last form. It consists of a number of tubes of a beautiful crimson colour, arranged in nearly parallel rows, and united at certain distances by transverse plates of the same material, which divide the series into ranges or stories, like the different floors of a house supported by many pillars. From the mouth of each tube is seen, when alive, a little Polype of a bright green hue, with eight tentacles, whose flesh, as it grows, gradually hardening,† forms the tube, and at regular intervals expanding horizontally, forms the thin floor in concert with its companions, each around its own tube; which being done, it again grows perpendicularly. It is abundant in the Indian Ocean.

The well-known and highly-prized Red Coral (*Corallium Rubrum*) consists of a stony branching stem, of extreme hardness, deposited by and covered with a sort of bark of living flesh, bearing at intervals

* *Tuba*, a pipe, and *porus*, a pore.

† "In these Polyparies, there is a real change of soft into solid substance, which is effected gradually, but not deposited in layers."—Jones's *Anim. Kingd.* p. 36.

what appear to be beautiful starry flowers, but are really Polypes with eight fringed tentacles, sometimes expanded, and sometimes contracted into little cells in the flesh. The stem is solid, not perforated, but furrowed down the surface : it is susceptible of a high polish. It is affixed by a broad base to the surface of rocks, in the Mediterranean, where it is the subject of a lucrative fishery. It grows with some rapidity, as places that have been exhausted are found by the coral-fishers to be in a few years quite replenished again. There are, however, local laws, which prohibit the too frequent disturbance of the beds.

But the most important of these animals is found in a group which is commonly known by the name of Madrepore, whose stony centres, seen in every cabinet, form thin perpendicular plates, which run to a centre, or terminate in waving lines, and by their thinness and close position remind us of the gills of a mushroom. At the hollows in the centres, where these leaves converge, were found, when alive, the Polypes by which the mass was secreted. Feeble, and apparently insignificant as these animals are, they have a mighty work assigned to them by God, and perform an important office in the economy of the earth. Vast reefs of solid rock which oppose an unyielding breast to the waves of the broad Pacific, and even large clusters of islands, inhabited by thousands of now civilized and Christian men, have been raised by the united efforts of millions of

minute Polypes, (*Madrepora** *Muricata*, &c.,) often known as the White Coral. Its form is branching, and appears composed of numberless oblong cells, overlapping each other, and set much like the blossoms of our common Heaths; the mouth of each cell displaying the star-like radiation of stony leaves, above-mentioned. It is of these that Lamouroux says,—“ Some by their union or aggregation, form a long narrow ridge or reef which extends uninterruptedly several degrees, opposing an immovable rampart to the great currents of the sea, which it often traverses, the solidity and magnitude of which increase daily. Sometimes this line of madreporic rocks assumes a circular form; the Polypes that inhabit it gradually elevating their rocky dwelling to the surface of the sea; working then in a sheltered basin, they by little and little fill up its voids, taking the precaution, however, to leave in the upper part of this impenetrable wall, openings by which the water can enter and retire, so as to renew itself, and furnish them with a constant supply of their aliment, and of the material with which they erect their habitation.”† It must, however, be admitted that recent observations have made it necessary in some degree to qualify these statements. It appears probable that the Polype only works in water already comparatively shallow, and that where islands are raised above water, or reefs are elevated to the

* *Mador*, moisture, and *porus*, a pore.

† *Expos. Méthod. des Polypiers.*

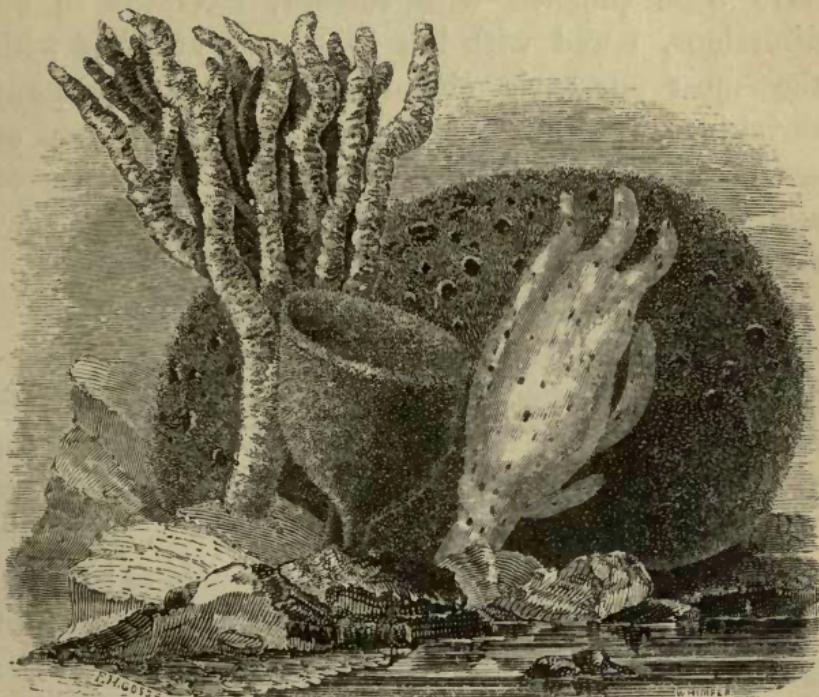
surface from a great depth, the action of the Polype is confined to the encrusting over, pretty thickly it may be allowed, steep rocks previously existing there. Submarine volcanoes may occasionally lift a broad surface of the ocean-bottom, on which thick layers of madrepores exist, and wherever this formation is found above the level of the tide, this must undoubtedly have been the case.

In some of this Order, the connecting substance is of a fleshy texture, without any stony centre, as in *Cydonium*.* This consists of an oblong, somewhat rounded mass, affixed to the rocks by a broad flat base, of a soft, but somewhat gristly substance. The surface is studded with little cells, in which are lodged minute Polypes with eight tentacles. The whole mass is capable of contraction and dilatation.

The coralline skeleton assumes a singular form in the Sea-Pens (*Pennatula*), consisting of a lengthened stem or axis, supporting a double series of jointed branches, on which the Polypes are arranged. The whole form is that of a feather; and as it is not fixed to any other substance, it has been supposed to have the power of swimming in the sea, by the motion of the branches; but this fact is not sufficiently established.

* Κυδώνιον, *kydonion*, a quince.

CLASS VI.—PORIFERA.*



SPONGES.

THE creatures of this Class, familiarly known by the name of Sponges, exhibit the very lowest state of animal life; so low, indeed, that there is great difficulty in proving their animal nature at all. Firmly rooted to the rock on which it grows, like a

* Πόρος, *poros*, a pore, and φέρω, *phero*, to bear.

plant, the Sponge has not the slightest power of changing its position : "no indication of sensation has ever been witnessed in them ; contact, however rude, excites no movement or contraction which might indicate its being perceived ; no torture has ever elicited from them an intimation of suffering ; they have been pinched with forceps, lacerated in all directions, bored with hot irons, and attacked with the most energetic chemical stimulants, without shrinking, or exhibiting the remotest appearance of sensibility."* Finally, we discover no semblance of any cavity answering to a stomach ; nothing but canals which run in all directions through the mass.

The Common Sponge, (*Spongia*† *Officinalis*), is seen beneath a microscope to consist of a vast number of very slender, transparent, horny fibres, which join each other in every direction at various intervals, so as to form an irregular net-work. These fibres are highly elastic, returning after pressure to their former position, and thus allowing liquids to pervade the mass. In life, every fibre is coated with a thin glairy jelly, which forms the living part of the Sponge, the fibres being merely the supporting skeleton. Many species, although resembling this in general structure, are not at all elastic, but crush on pressure, owing to the presence of numerous needles or crystals of stony matter, which are scattered among the filaments.

Though no contraction, nor any voluntary motion, can be traced in the Sponge with the closest atten-

* Jones.

† Σπόγγος, *spongos*, its ancient Greek name.

tion, yet there is a constant and uniform action going on, which shews a living and energetic principle. Dr. Grant has described his discovery of this action in very interesting terms: "I put," he observes, "a small branch of the *Spongia Coalita*, with some sea-water, into a watch-glass, under the microscope: and on reflecting the light of a candle through the fluid, I soon perceived that there was some intestine motion in the opaque particles floating through the water. On moving the watch-glass, so as to bring one of the apertures on the side of the Sponge fully into view, I beheld, for the first time, the splendid spectacle of this living fountain, vomiting forth from a circular cavity, an impetuous torrent of liquid matter, and hurling along, in rapid succession, opaque masses, which it strewed every where around. The beauty and novelty of such a scene in the animal kingdom, long arrested my attention, but after twenty-five minutes of constant observation, I was obliged to withdraw my eye from fatigue, without having seen the torrent for one instant change its direction, or diminish, in the slightest degree, the rapidity of its course. I continued to watch the same orifice at short intervals, for five hours, sometimes observing it for a quarter of an hour at a time; but still the stream rolled on with a constant and equal velocity." The water which is thus poured from all the large apertures of the mass, is doubtless received through the minute pores, and having contributed aliment to the body, is discharged, exhausted of its nutritive matter.

The mode by which the Sponges increase their race is highly curious: at stated periods, there project from the interior of the large canals yellowish buds, which grow until at length they are detached, and are driven with the perpetual torrent into the surrounding sea. Here one would naturally expect that so apparently helpless an atom of jelly would sink to the bottom at once by the side of its parent. But if this were the case, it is easy to perceive that one particular spot would be loaded and overgrown with Sponges, which would clog and choke each other, while the waste around would be destitute of any. To remedy this, a power of motion is given to the tiny *gemmule*, of which the parent is totally deprived. The microscope discovers the greater part of its surface to be covered with minute *cilia*, which by their rapid vibrations propel it swiftly along through the sea, until being arrived at a sufficient distance from the place of its birth, it quietly settles on the bottom, loses its *cilia*, and acquires the form and character of a Sponge.

Many Sponges are remarkable for the singularity of their forms, sometimes spreading into broad leaves or fans; sometimes cylindrical like a thick stick; now assuming the form of a hand; and often hollowed out in the shape of a cup, with a foot like a vase. They occur abundantly on all shores from Greenland to Australia, but are most numerous and gigantic in hot latitudes. The Common Sponge of commerce, is chiefly found in the Mediterranean, where, especially among the beautiful Isles of

Greece, an important fishery and traffic are carried on for this article. "At the Cyclades for instance, sponge-diving forms the chief employment of the population. The sea is at all times exceedingly clear, and the experienced divers are able to distinguish from the surface the points to which the Sponge is attached below, when an unpractised eye could but dimly discover the bottom. Each boat is furnished with a large stone attached to a rope, and this the diver seizes in his hand on plunging head foremost from the stern. He does this in order to increase the velocity of his descent, thus economising his stock of breath; as well as to facilitate his ascent when exhausted at the bottom, being then quickly hauled up by his companions. Few men can remain longer than two minutes below; and as the process of detaching the Sponge is very tedious, three and sometimes four divers descend successively to secure a particularly fine specimen."* This fishery appears to have been carried on in the same localities in very ancient times. Tournefort informs us that of so much importance is it considered, that no youth is allowed to marry until he has given proof of his proficiency in the art of diving.

Here we close. Rapid as has been our course through this magnificent and grand array of living beings, and few and slight as have been the gleanings which we have gathered, we cannot rise from the study,

* Penny Mag. 1834, p. 27.

without deepened convictions of the littleness and insignificance of Man, and enlarged conceptions of the power, the wisdom, and the love of the Creator, God. We cannot fail to perceive that there are millions of creatures over which man has no control, and that do him no homage ; that the “ waste-places ” of the earth and ocean are full of beings which he has never seen, and which live in a world of their own, unconscious of his existence. It is equally obvious, however, that these are the objects of creative skill and providential care ; that the Almighty Father has formed their organs with a most minute and accurate adaptation to their wants ; and has watched over their welfare with a most tender and incessant love. Thus does the whole Creation, as with one voice, bear eloquent testimony to the great truth recorded in the pages of Revelation, that “ GOD IS LOVE ; ” the Infinite Benevolence shown in the creation of beings, endowed with a capacity for happiness, and supplied with the means of enjoyment, being exceeded only by the inestimable love exhibited in the Redemption of a fallen world. “ The Lord is good to ALL : and His tender mercies are over ALL His works.”

“ LO, THESE ARE PARTS OF HIS WAYS : BUT HOW LITTLE A PORTION IS HEARD OF HIM ! BUT THE THUNDER OF HIS POWER WHO CAN UNDERSTAND ? ”

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